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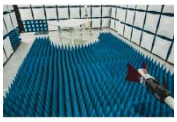

TEST REPORT
PART 96 MEASUREMENT REPORT

Applicant Name:
EUCAST Co., Ltd.
(13595) 4th FL Sungok Bldg, 262,
Hwangsaeul-ro Bundang-Gu, Seongnam-si,
Gyeonggi-do, Korea

Date of Testing:
06/27/2022 – 07/13/2022
Test Site/Location:
Element Lab., Suwon,
Yongin-si, Gyeonggi-do, Korea
Test Report Serial No.:
8K22062201-00-R1.2AXTR

FCC ID:	**2AXTR-EPL2248-1690**
APPLICANT:	**EUCAST Co., Ltd.**

Application Type:	Certification
Model:	EPL2248-1690
EUT Type:	LTE portable base station
FCC Classification:	Citizens Band Category B Devices (CBD)
FCC Rule Part(s):	96
Test Procedure(s):	ANSI C63.26-2015, ANSI/TIA-603-E-2016, KDB 971168 D01 v03r01, KDB 940660 D01 v02, KDB 662911 D01 v02r01

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in §2.947. Test results reported herein relate only to the item(s) tested.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

ACCREDITED
CERT #2041.04

Prepared by DuJin Kim
Test Engineer

Reviewed by Charles.Shin
Technical Manager

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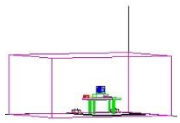
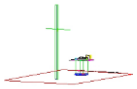


MEASUREMENT REPORT
FCC Rule Part 96



Mode	Tx Frequency (MHz)	Max. PSD (dBm/1MHz)	Max. EIRP (dBm/10MHz)	Max. EIRP /Entire Band width(dBm)	Max. EIRP /Entire Band width(W)	Emission Designator	Modulation
LTE_1C_10M	3550 - 3700	28.60	37.59	37.59	5.74	8M98G7D	QPSK
		28.87	37.61	37.61	5.77	8M97W7D	QAM
LTE_1C_20M		28.45	37.50	40.01	10.02	17M9G7D	QPSK
		28.62	37.77	40.35	10.84	18M0W7D	QAM

EUT Overview

1.0 REVISION RECORD

Issue Number	Issued Date	Revision History
8K22062201-00.2AXTR	07/13/2023	Initial Issue
8K22062201-00-R1.2AXTR	07/26/2023	Revision due to revised test note

2.0 INTRODUCTION

2.1 Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Innovation, Science and Economic Development Canada.

2.2 Element Materials Technology Suwon Test Location

These measurement tests were conducted at the Element Materials Technology Suwon. Ltd. facility located at (#1407) 13, Heungdeok 1-ro, Giheung-gu, Yongin-si, Gyeonggi-do 16954, Korea.

2.3 Test Facility / Accreditation

Measurements were performed at Element Materials Technology Suwon Lab located in Yongin-si, Gyeonggi, Korea.

- Element Materials Technology Suwon is an ISO 17025-2017 accredited test facility under the American Association for Laboratory Accreditation(A2LA) with Certificate number 2041.04 for Specific Absorption Rate (SAR), where applicable, and Electromagnetic Compatibility (EMC) testing for FCC and Innovation, Science, and Economic Development Canada rules.

- Element Materials Technology Suwon facility is accredited, designated, and recognized in accordance with the provision of Radio Wave Act and International Standard ISO/IEC 17025:2017 under the National Radio Research Agency.

  - Designation Number / CABID: KR0169
  - Test Firm Registration Number of FCC: 417945
  - Test Firm Registration Number of IC: 26168

3.0 PRODUCT INFORMATION

3.1 Equipment Description

The Equipment Under Test (EUT) is the **EUCAST Co., Ltd. CBSD FCC ID: 2AXTR-EPL2248-1690.**
The test data contained in this report pertains only to the emissions due to the EUT's LTE Band 48 operation in the CBRS band. Per FCC Part 96, this device is evaluated under Citizens Band Category B Devices (CBD).

This device supports the following conditional features:

EUT Type:	LTE portable base station	
Model Name:	EPL2248-1690	
Test Device Serial No.:	EE0A0100223000005	
Device Capabilities:	LTE	
Operating Band:	Band	Tx (Downlink) / Rx (Uplink)
	B48:	3550 MHz to 3700 MHz / 3550 MHz to 3700 MHz
Supported Number of Carriers:	Max. 1 carrier	
Supported Modulation:	QPSK (E-TM 1.1), 16QAM (E-TM 3.2), 64QAM (E-TM 3.1)	
Supported Channel Bandwidth:	10MHz, 20MHz	
Maximum Output Power	10 MHz	29 dBm/Path
	20 MHz	32 dBm/Path
Number of Antenna ports	2	
Supported Configurations:	Single carrier	
Input Voltage:	12 VDC Battery, 24 VDC External power source	
Antenna Gain:	Max. 6 dBi	

3.2 Test Configuration

The setup is as follows:

a) The EUT “EPL2248-1690” powered by 24V DC power supply.
b) The EUT is connected to a test laptop via an ethernet cable acting as backhaul.
c) An RF cable connects the signal analyzer and the EUT Ports for respective measurement.

The voltage fluctuation of internal DC power supply feeding the RF portion of the equipment is same when an 24V external voltage source or 12V Battery. During the test, EUT supplied the 24V rated external voltage source. And Spot check verification was adopted to the following Radiated unwanted emission test to check whether it is changed by power supply difference.

The EUT was tested per the guidance of ANSI/TIA-603-E-2016 and KDB 971168 D01 v03r01. See Section 7.0 of this test report for a description of the antenna port conducted emissions tests.

The following information is about configurations of carrier frequency and output power per port declared by the manufacturer.

* Abbreviations:

- B48: Band 48
- 10M: 10MHz Bandwidth
- 20M: 20MHz Bandwidth

Configuration	No. of Carriers	Carrier Bandwidth (MHz)	Carrier Frequency Configuration (MHz)			Rated Power (dBm/path)
			Lowest	Middle	Highest	
LTE_B48_10M	1	10	3555	3625	3695	29
LTE_B48_20M	1	20	3560	3620	3690	32

3.3 EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and no modifications were made during testing.

4.0 DESCRIPTION OF TESTS

4.1 Measurement Procedure

The measurement procedures described in the document titled “American National Standard for Compliance Testing of Transmitter Used in Licensed Radio Service” (ANSI C63.26-2015) and the guidance provided in KDB 971168 D01 v03r01, and KDB 662911 D01 v02r01 and KDB 940660 D01 were used in the measurement of the EUT.

Occupied Bandwidth:
KDB 971168 D01 v03r01 – Section 4.3
ANSI C63.26-2015 – Section 5.4.4

Modulation Characteristics:
KDB 971168 D01 v03r01 – Section 3
ANSI C63.26 - Section 5.3

Conducted Power Measurement and EIRP and PSD
KDB 971168 D01 v03r01 – Section 5.3
KDB 971168 D01 v03r01 – Section 5.4
KDB 662911 D01 v02r01 – Section E)1) In-Band Power Measurements
ANSI C63.26-2015 – Section 5.2.5
ANSI C63.26-2015 – Section 5.2.4

Peak-to-Average Power Ratio:
KDB 971168 D01 v03r01 – Section 5.7
ANSI C63.26-2015 – Section 5.2.6

Channel Edge Emissions at Antenna Terminal
KDB 971168 D01 v03r01 – Section 6
KDB 662911 D01 v02r01 – Section E)3) Out-of-Band and Spurious Emission Measurements
a) Absolute Emission Limits
iii) Measure and add 10 log(N_{ANT}) dB
ANSI C63.26-2015 – Section 5.7

Spurious and Harmonic Emissions at Antenna Terminal
KDB 971168 D01 v03r01 – Section 6
KDB 662911 D01 v02r01 – Section E)3) Out-of-Band and Spurious Emission Measurements
a) Absolute Emission Limits
iii) Measure and add 10 log(N_{ANT}) dB
ANSI C63.26-2015 – Section 5.7

Radiated unwanted emission
KDB 971168 D01 v03r01 – Section 7
ANSI C63.26-2015 – Section 5.5

Frequency Stability / Temperature Variation
KDB 971168 D01 v03r01 – Section 9
ANSI C63.26-2015 – Section 5.6

4.2 Measurement Software

Test item	Name	Version
Conducted Measurement	Node B automation	1.0

5.0 MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.4-2014. All measurement uncertainty values are shown with a coverage factor of k = 2 to indicate a 95% level of confidence. The measurement uncertainty shown below meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Contribution	Expanded Uncertainty (±dB)
Conducted Bench Top Measurements	1.37
Radiated Disturbance (<1GHz)	3.94
Radiated Disturbance (>1GHz)	4.75
Radiated Disturbance (>18GHz)	4.84

6.0 TEST EQUIPMENT CALIBRATION DATA

Test Equipment Calibration is traceable to the National Institute of Standards and Technology (NIST). Measurements antennas used during testing were calibrated in accordance to the requirements of ANSI C63.5-2017.

Manufacture	Model	Description	Cal Date	Cal interval	Cal Due	Serial Number
AC POWER KOREA	ACPD-60150	DC POWER SUPPLY	01/18/2022	Annual	01/17/2023	ZL000972
Rohde & Schwarz	FSW43	Signal & Spectrum Analyzer	07/05/2022	Annual	07/04/2023	101250
KEYSIGHT	N9030B	PXA Signal Analyzer	05/09/2022	Annual	05/08/2023	MY57142018
Rohde & Schwarz	TS-SFUNIT-Rx	Shielded Filter Unit	03/02/2022	Annual	03/01/2023	102131
Schwarzbeck	VULB9162	Broadband TRILOG Antenna	07/13/2021	Biennial	07/12/2023	9162-217
Sunol sciences	DRH-118	Horn Antenna	01/12/2021	Biennial	01/11/2023	A060215
Schwarzbeck	BBHA 9170	Horn Antenna	01/27/2022	Biennial	01/26/2024	1037
Weinschel	49-30-33	Attenuator	10/22/2021	Annual	10/21/2022	NB338
Weinschel	49-30-33	Attenuator	10/22/2021	Annual	10/21/2022	NB340
RF One	RFHB1810SC10	Attenuator	01/18/2022	Annual	01/17/2023	RFHB0004
RF One	RFHB1810SC10	Attenuator	01/18/2022	Annual	01/17/2023	RFHB0005
RF One	RFHB1810SC10	Attenuator	01/18/2022	Annual	01/17/2023	RFHB0006
RF ONE ELECTRONICS	CTF-3560M-280MS1	Band Reject Filter	07/06/2022	Annual	07/05/2023	X1909007

Table 6-1. Test Equipment

Notes:

1. For equipment listed above that has a calibration date or calibration due date that falls within the test date range, care was taken to ensure that this equipment was used after the calibration date and before the calibration due date.

2. All testing was performed before the calibration due date.

7.0 SAMPLE CALCULATIONS

Emission Designator

QPSK Modulation

Emission Designator = 8M98G7D

Occupied Bandwidth = 8.98 MHz
G = Phase Modulation
7 = Quantized/Digital Info
D = Data transmission, telemetry, telecommand

QAM Modulation

Emission Designator = 8M97W7D

Occupied Bandwidth = 8.97 MHz
W = Amplitude/Angle Modulated
7 = Quantized/Digital Info
D = Data transmission, telemetry, telecommand

8.0 TEST RESULTS

8.1 Summary

Company Name: EUCAST Co., Ltd.

FCC ID: 2AXTR-EPL2248-1690

Type of Radio Equipment: Citizens Band Category B Devices (CBD)

Mode(s): LTE

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
2.1049	Occupied Bandwidth	N/A	CONDUCTED	PASS	Section 8.2
2.1046 96.41(a)	Modulation Characteristics	Digital modulation		PASS	Section 8.3
2.1046 96.41(b)	Power Spectral Density (PSD)	37 dBm/MHz (PSD)		PASS	Section 8.4
2.1046 96.41(b)	Equivalent Isotropic Radiated Power (EIRP)	47 dBm/10MHz (EIRP)		PASS	Section 8.5
96.41(g)	Peak-Average Ratio	≤ 13 dB		PASS	Section 8.6
2.1051 96.41(e)	Out of Band Emissions	Within 0 MHz to 10 MHz above and below the assigned channel ≤ −13 dBm/MHz Greater than 10 MHz above and below the assigned channel ≤ −25 dBm/MHz Any emission below 3530 MHz and above 3720 MHz ≤ −40 dBm/MHz		PASS	Section 8.7
2.1055 96.41(e)	Frequency Stability	Fundamental emissions stay within authorized frequency block		PASS	Section 8.9
2.1051 96.41(e)	Radiated unwanted emission	≤ −40dBm/MHz	Radiated	PASS	Section 8.8

Table 8-1. Summary of Test Results

Notes:

1) All modes of operation and data rates were investigated.
   The test results shown in the following sections represent the worst case emissions.
2) The analyzer plots were all taken with a correction table loaded into the analyzer.
3) All antenna port conducted emissions testing was performed on a test bench with the antenna port of the EUT connected to the spectrum analyzer through calibrated cables and attenuators.

8.2 Occupied Bandwidth

Test Overview

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured. All modes of operation were investigated and the worst case configuration results are reported in this section.

Test Procedure Used

KDB 971168 D01 v03r01 – Section 4.3
ANSI C63.26-2015 – Section 5.4.4

Test Setting

The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. The spectrum analyzer setting were as follows:

1. The signal analyzer's automatic bandwidth measurement capability was used to perform the 99% occupied bandwidth. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. RBW = 1 – 5% of the expected OBW
3. VBW ≥ 3 x RBW
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. The trace was allowed to stabilize
8. If necessary, steps 2 – 7 were repeated after changing the RBW such that it would be within 1 – 5% of the 99% occupied bandwidth observed in Step 7

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

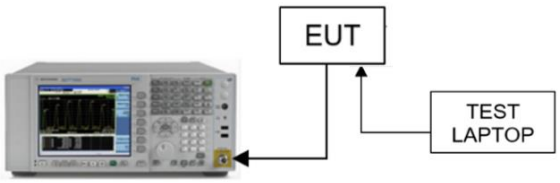


Figure 8-1. Test Instrument & Measurement Setup

Limit

The occupied bandwidth shall not exceed the equipment's channel bandwidth, which is declared by the manufacturer.

Test Notes

None.

Channel	Port	OBW (MHz)		
		QPSK	16QAM	64QAM
Low	0	8.95	8.93	8.96
	1	8.96	**8.97**	8.94
Middle	0	8.96	8.91	8.94
	1	**8.98**	8.96	8.95
High	0	8.97	8.97	8.93
	1	8.97	8.95	8.92

Table 8-2. Occupied Bandwidth Summary Data (LTE_B48_10M)

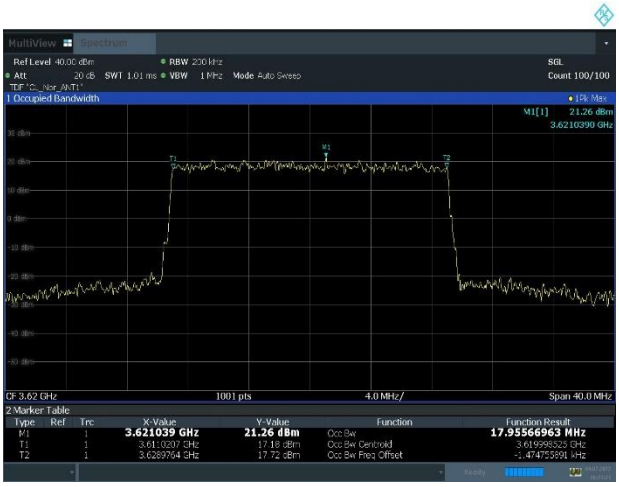
Channel	Port	OBW (MHz)		
		QPSK	16QAM	64QAM
Low	0	17.84	17.85	17.84
	1	**17.90**	17.84	17.92
Middle	0	17.83	17.84	17.83
	1	17.82	17.85	**17.96**
High	0	17.87	17.85	17.90
	1	17.89	17.84	17.82

Table 8-3. Occupied Bandwidth Summary Data (LTE_B48_20M)

Plot 8-1. Occupied Bandwidth Plot
(LTE_B48_10M_QPSK - Mid Channel, Port 1)

Plot 8-2. Occupied Bandwidth Plot
(LTE_B48_10M_16QAM - Low Channel, Port 1)

Plot 8-3. Occupied Bandwidth Plot
(LTE_B48_20M_QPSK - Low Channel, Port 1)



Plot 8-4. Occupied Bandwidth Plot
(LTE_B48_20M_64QAM - Mid Channel, Port 1)

8.3 Modulation Characteristics

Test Overview

Verification of a curve or equivalent data that shows that the equipment will meet the modulation requirements of the rules under which the equipment is to be licensed.

Test Procedure Used

KDB 971168 D01 v03r01 – Section 3
ANSI C63.26 - Section 5.3

Test Setting

The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. The spectrum analyzer setting were as modulation analyzer mode.

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

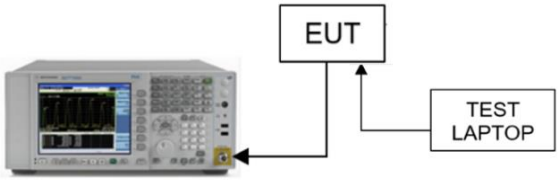


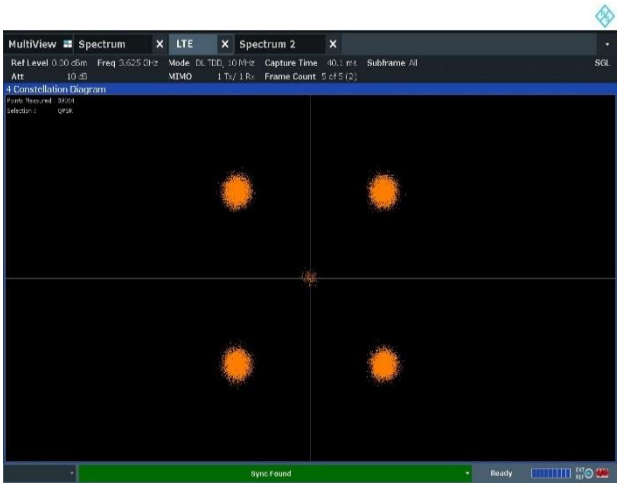
Figure 8-2. Test Instrument & Measurement Setup

Limit

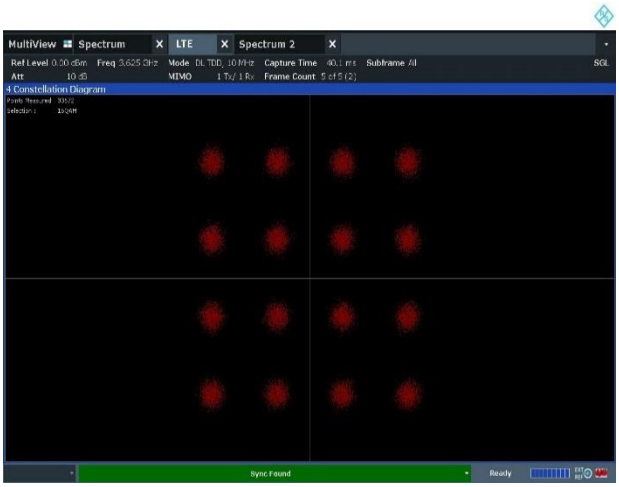
Systems operating in the Citizens Broadband Radio Service must use digital modulation techniques.

Test Notes

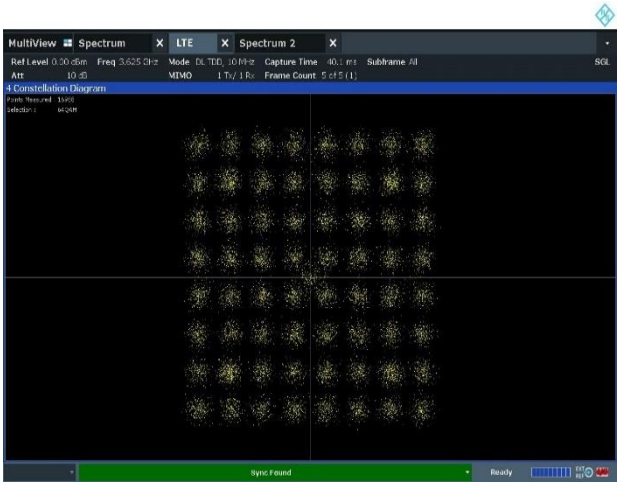
Systems operating used digital modulation techniques.



Plot 8-5. Modulation Characteristics Plot
(LTE_B48_10M_QPSK Modulation)



Plot 8-6. Modulation Characteristics Plot
(LTE_B48_10M_16QAM Modulation)



Plot 8-7. Modulation Characteristics Plot
(LTE_B48_10M_64QAM Modulation)

8.4 Power Spectral Density

Test Overview

A transmitter port of EUT is connected to the input of a signal analyzer. All measurements are performed as RMS average measurements while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies.

Test Procedure Used

KDB 971168 D01 v03r01 – Section 5.3
KDB 971168 D01 v03r01 – Section 5.4
KDB 662911 D01 v02r01 – Section E)1) In-Band Power Measurements
ANSI C63.26-2015 – Section 5.2.5
ANSI C63.26-2015 – Section 5.2.4

Test Setting

The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. The spectrum analyzer settings were as follows:

The PSD is measured following the same procedures described in 5.2.4.4 of ANSI C63.26 for measuring the total average power, but with the RBW set to the reference bandwidth specified by the applicable regulatory requirement, and by using the marker function to identify the maximum PSD instead of summing the power across the OBW. If the fundamental measurement condition cannot be realized, then one of the alternative procedures in 5.2.4.4.2 or 5.2.4.4.3 should be selected, based on whether the transmitter duty cycle is constant (variations ≤ ±2%) or non-constant (variations > ±2%), respectively.

1. Conducted power measurements are performed using the signal analyzer's "SA mode" measurement capability for signals with continuous operation.
2. Set span to 2 × to 3 × the OBW.
3. Set RBW = 1 MHz (the reference bandwidth)
4. Set VBW ≥ 3 × RBW.
5. Set number of measurement points in sweep ≥ 2 × span / RBW.
6. Sweep time:
   a) Set ≥ auto-couple, and enable trace averaging, or
   b) Set ≥ [10 × (number of points in sweep) × (transmission symbol period)] and enable a single sweep (automation-compatible) measurement. The sweep time should never be faster than the auto-coupled sweep time.
7. Detector = power averaging (rms).
8. The trace was allowed to stabilize
9. Use the peak marker function to determine the maximum amplitude level. (=P_{Meas})
10. The relevant equation for determining the maximum EIRP from the measured RF output power is given in Equation as follows:
    EIRP = P_{Meas} + G_T
    where
    GT: gain of the transmitting antenna, in dBi (EIRP).

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

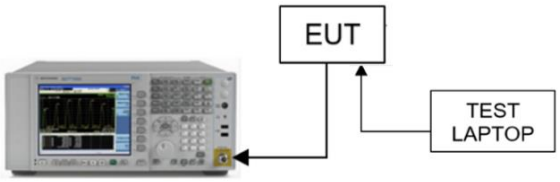


Figure 8-3. Test Instrument & Measurement Setup

Limit

Category B CBSD : 37 dBm/MHz

Test Notes

1. Consider the following factors for MIMO Power Spectral Density:
   The power spectal density is meausred as dBm / MHz, with the resolution bandwidth of 1 MHz PSDs are summed up in linear using the measure-and-sum technique defined in KDB 971168 D01 v03r01 - Section E) 2).
2. Periodic trigger was used with gating ON. Gate sweeptime, Gate delay and gate length were set accordingly to capture ON time of the transmission.
3. PSD per port (dBm / MHz) is converted to a linear value (mW). A summation of linear powers for all ports gives us the total MIMO cunducted Power (mW). We convert this back to logarithmic scale for further PSD calcuations.
4. Antenna Gains (dBi) are provided by the client.
5. All transmit signals from different antennas are completely uncorrelated with eath other. So the the e.i.r.p. shall be calculated based on the aggregate power conducted across all antennas and maximum antenna gain G_{max}.
6. Sample Calculation:
   Let us assume the following numbers:
   a) Total MIMO Conducted Power as 177.95 mW
   b) Antenna Gain = 6.0 dBi

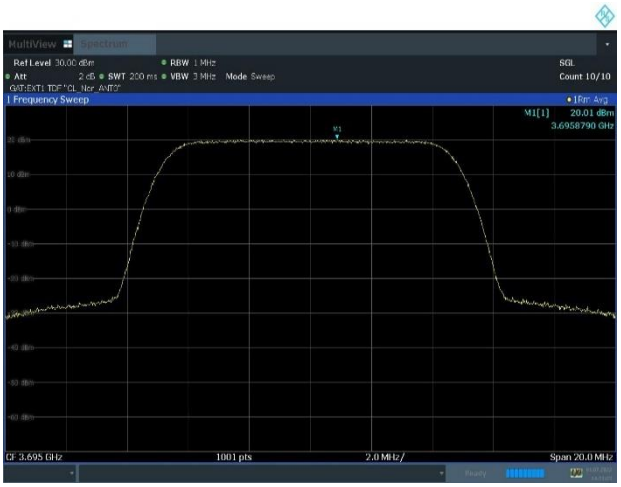
Factors			Value	Unit
Summed MIMO Conducted Power (linear sum)			177.95	mW
Summed MIMO Conducted Power (dBm)	= 10 * log (177.95) =		22.50	dBm/MHz
Antenna Gain			6.00	dBi
Total MIMO EIRP			28.50	mW
Limit			37.00	dBm/MHz
Margin = Limit - Total MIMO EIRP	= 28.50 – 37.00	=	-8.50	dB

Low Channel	Port	QPSK	16QAM	64QAM
Conducted Power (dBm/MHz)	0	19.64	19.76	19.85
	1	19.34	19.59	19.52
Total MIMO Conducted Power (mW/MHz)		177.95	185.62	186.14
Total MIMO Conducted Power (dBm/MHz)		22.50	22.69	22.70
Ant. Gain (dBi)		6.00	6.00	6.00
e.i.r.p PSD (dBm/MHz)		28.50	28.69	28.70
e.i.r.p PSD Limit(dBm/MHz)		37.00	37.00	37.00
Margin (dB)		-8.50	-8.31	-8.30
Mid Channel	Port	QPSK	16QAM	64QAM
Conducted Power (dBm/MHz)	0	19.77	19.82	20.03
	1	19.11	19.22	19.64
Total MIMO Conducted Power (mW/MHz)		176.31	179.50	192.74
Total MIMO Conducted Power (dBm/MHz)		22.46	22.54	22.85
Ant. Gain (dBi)		6.00	6.00	6.00
e.i.r.p PSD (dBm/MHz)		28.46	28.54	28.85
e.i.r.p PSD Limit(dBm/MHz)		37.00	37.00	37.00
Margin (dB)		-8.54	-8.46	-8.15
High Channel	Port	QPSK	**16QAM**	64QAM
Conducted Power (dBm/MHz)	0	19.87	**20.01**	20.15
	1	19.29	**19.71**	19.52
Total MIMO Conducted Power (mW/MHz)		181.97	**193.77**	193.05
Total MIMO Conducted Power (dBm/MHz)		22.60	**22.87**	22.86
Ant. Gain (dBi)		6.00	**6.00**	6.00
e.i.r.p PSD (dBm/MHz)		28.60	**28.87**	28.86
e.i.r.p PSD Limit(dBm/MHz)		37.00	**37.00**	37.00
Margin (dB)		-8.40	**-8.13**	-8.14

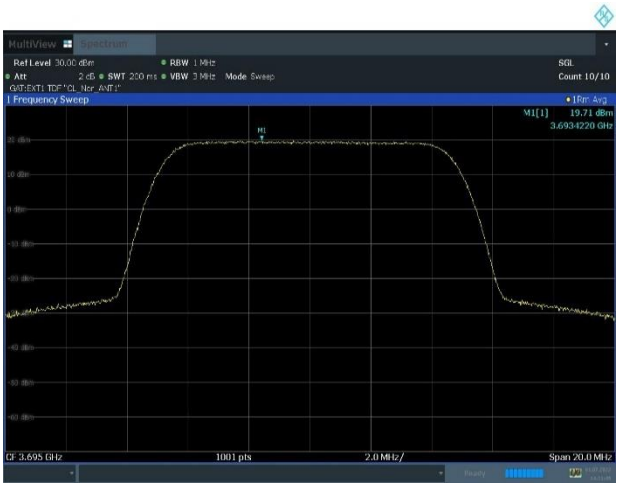
Table 8-4. Power Spectral Density Table (LTE_B48_10M)

Low Channel	Port	QPSK	**16QAM**	64QAM
Conducted Power (dBm/MHz)	0	20.08	**20.26**	20.23
	1	18.70	**18.85**	18.86
Total MIMO Conducted Power (mW/MHz)		175.99	**182.91**	182.35
Total MIMO Conducted Power (dBm/MHz)		22.45	**22.62**	22.61
Ant. Gain (dBi)		6.00	**6.00**	6.00
e.i.r.p PSD (dBm/MHz)		28.45	**28.62**	28.61
e.i.r.p PSD Limit(dBm/MHz)		37.00	**37.00**	37.00
Margin (dB)		-8.55	**-8.38**	-8.39
Mid Channel	Port	QPSK	16QAM	64QAM
Conducted Power (dBm/MHz)	0	19.42	19.54	19.47
	1	18.62	18.74	18.70
Total MIMO Conducted Power (mW/MHz)		160.28	164.77	162.64
Total MIMO Conducted Power (dBm/MHz)		22.05	22.17	22.11
Ant. Gain (dBi)		6.00	6.00	6.00
e.i.r.p PSD (dBm/MHz)		28.05	28.17	28.11
e.i.r.p PSD Limit(dBm/MHz)		37.00	37.00	37.00
Margin (dB)		-8.95	-8.83	-8.89
High Channel	Port	QPSK	16QAM	64QAM
Conducted Power (dBm/MHz)	0	19.50	19.43	19.38
	1	18.68	19.09	19.06
Total MIMO Conducted Power (mW/MHz)		162.92	168.80	167.23
Total MIMO Conducted Power (dBm/MHz)		22.12	22.27	22.23
Ant. Gain (dBi)		6.00	6.00	6.00
e.i.r.p PSD (dBm/MHz)		28.12	28.27	28.23
e.i.r.p PSD Limit(dBm/MHz)		37.00	37.00	37.00
Margin (dB)		-8.88	-8.73	-8.77

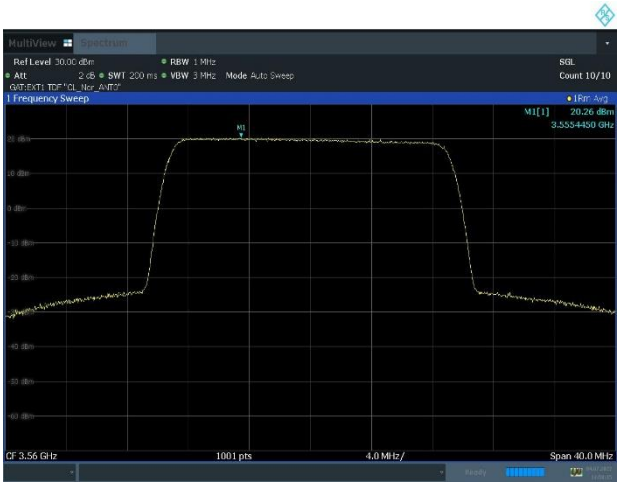
Table 8-5. Power Spectral Density Table (LTE_B48_20M)



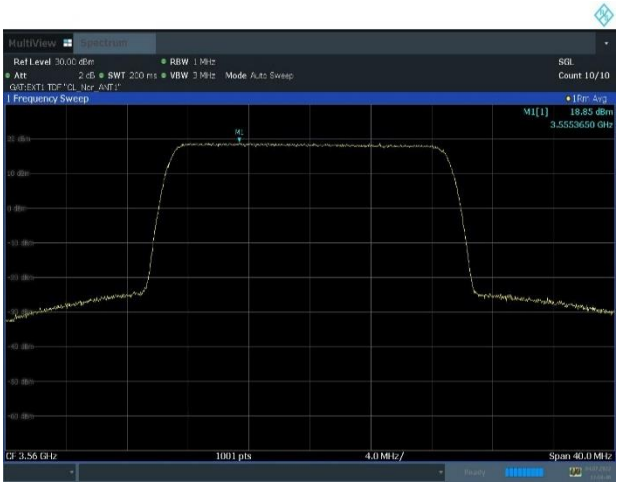
Plot 8-8. Power Spectral Density Plot
(LTE_B48_10M_16QAM- High Channel, Port 0)



Plot 8-9. Power Spectral Density Plot
(LTE_B48_10M_16QAM- High Channel, Port 1)



Plot 8-10. Power Spectral Density Plot
(LTE_B48_20M_16QAM - Low Channel, Port 0)



Plot 8-11. Power Spectral Density Plot
(LTE_B48_20M_16QAM - Low Channel, Port 1)

8.5 Equivalent Isotropic Radiated Power (EIRP)

Test Overview

A transmitter port of EUT is connected to the input of a signal analyzer. All measurements are performed as RMS average measurements while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies.

Test Procedure Used

KDB 971168 D01 v03r01 – Section 5.3
KDB 971168 D01 v03r01 – Section 5.4
KDB 662911 D01 v02r01 – Section E)1) In-Band Power Measurements
ANSI C63.26-2015 – Section 5.2.5
ANSI C63.26-2015 – Section 5.2.4

Test Setting

The measurement was made using a direct connection between the RF output of the EUT and the specturm analyzer. The specturm analyzer setting were as follows:

1. Conducted power measurements are performed using the signal analyzer's "channel power" measurement capability for signals with continuous operation.
2. IBW = 10 MHz (the reference bandwidth)
3. RBW = 1 ~ 5% of the expected OBW
4. VBW ≥ 3 x RBW
5. Span = 2 ~ 3 x OBW
6. No. of sweep points ≥ 2 x span / RBW
7. Detector = RMS
8. Trace mode = Trace-Averaging (RMS) set to average over 100 sweeps
9. The trace was allowed to stabilize

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

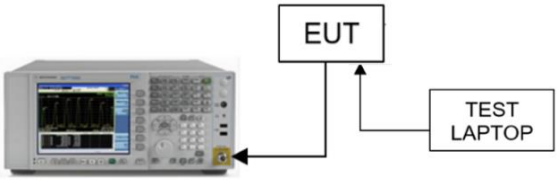


Figure 8-4. Test Instrument & Measurement Setup

Limit

Category B CBSD: 47dBm/10 MHz

Note

1. Periodic trigger was used with gating ON. Gate sweeptime, Gate delay and gate length were set accordingly to capture ON time of the transmission.

2. MIMO Calculations are done considering output channel power for all ports and respective margins are calculated according to procedures in section 6.4 of ANSI C63.26 and section D of KDB 971168 D01 v03r01.

3. Consider the following factors for MIMO Power:
   c) Conducted power for each port is measured in dBm.
   d) Powers are summed up in linear using the measure-and-sum technique defined in KDB 971168 D01 v03r01-Section D.
   e) Conducted power per port (dBm) is converted to a linear value (mW). A summation of linear powers for all ports gives us the total MIMO conducted power in milliWatts (mW).

4. All transmit signals from different antennas are completely uncorrelated with eath other. So the the e.i.r.p. shall be calculated based on the aggregate power conducted across all antennas and maximum antenna gain G_{max}.

5. Sample Calculation:
   Let us assume the following numbers:
   c) Total MIMO Conducted Power as 1363.59 mW
   d) Antenna Gain = 6.0 dBi

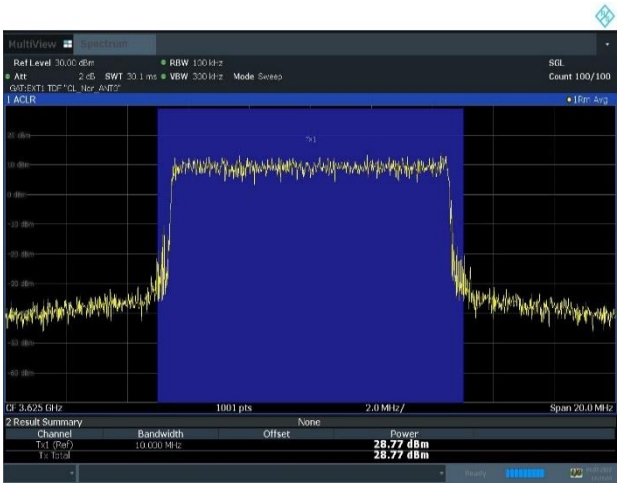
Factors			Value	Unit
Summed MIMO Conducted Power (linear sum)			1363.59	mW
Summed MIMO Conducted Power (dBm)	= 10 * log (1363.59) =		31.35	dBm/10MHz
Antenna Gain			6.00	dBi
Total MIMO EIRP			37.35	dBm/10MHz
Limit			47.00	dBm/10 MHz
Margin = Limit - Total MIMO EIRP	= 37.35 – 47.00	=	-9.65	dB

Low Channel	Port	QPSK	16QAM	64QAM
Conducted Power (dBm/10MHz)	0	28.45	28.43	28.53
	1	28.22	28.20	28.20
Total MIMO Conducted Power (mW/10MHz)		1363.59	1359.32	1375.55
Total MIMO Conducted Power (dBm/10MHz)		31.35	31.33	31.38
Ant. Gain (dBi)		6.00	6.00	6.00
e.i.r.p (dBm/10MHz)		37.35	37.33	37.38
e.i.r.p Limit(dBm/10MHz)		47.00	47.00	47.00
Margin (dB)		-9.65	-9.67	-9.62
Mid Channel	Port	QPSK	16QAM	**64QAM**
Conducted Power (dBm/10MHz)	0	28.75	28.55	**28.77**
	1	28.10	27.99	**28.41**
Total MIMO Conducted Power (mW/10MHz)		1397.55	1347.65	**1448.78**
Total MIMO Conducted Power (dBm/10MHz)		31.45	31.30	**31.61**
Ant. Gain (dBi)		6.00	6.00	**6.00**
e.i.r.p (dBm/10MHz)		37.45	37.30	**37.61**
e.i.r.p Limit(dBm/10MHz)		47.00	47.00	**47.00**
Margin (dB)		-9.55	-9.70	**-9.39**
High Channel	Port	QPSK	16QAM	64QAM
Conducted Power (dBm/10MHz)	0	28.84	28.69	28.90
	1	28.29	28.45	28.21
Total MIMO Conducted Power (mW/10MHz)		1442.12	1441.45	1440.46
Total MIMO Conducted Power (dBm/10MHz)		31.59	31.59	31.59
Ant. Gain (dBi)		6.00	6.00	6.00
e.i.r.p (dBm/10MHz)		37.59	37.59	37.59
e.i.r.p Limit(dBm/10MHz)		47.00	47.00	47.00
Margin (dB)		-9.41	-9.41	-9.41

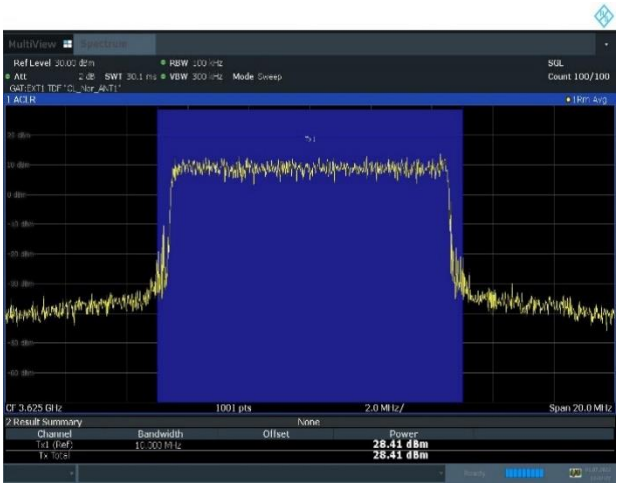
Table 8-6. Equivalent Isotropic Radiated Power Table (LTE_B48_10M)

Low Channel	Port	QPSK	**16QAM**	64QAM
Conducted Power (dBm/10MHz)	0	29.10	**29.41**	29.27
	1	27.79	**27.97**	27.90
Total MIMO Conducted Power (mW/10MHz)		1414.00	**1501.59**	1463.87
Total MIMO Conducted Power (dBm/10MHz)		31.50	**31.77**	31.66
Ant. Gain (dBi)		6.00	**6.00**	6.00
e.i.r.p (dBm/10MHz)		37.50	**37.77**	37.66
e.i.r.p Limit(dBm/10MHz)		47.00	**47.00**	47.00
Margin (dB)		-9.50	**-9.23**	-9.34
Mid Channel	Port	QPSK	16QAM	64QAM
Conducted Power (dBm/10MHz)	0	28.51	28.76	28.60
	1	27.74	27.98	27.94
Total MIMO Conducted Power (mW/10MHz)		1305.87	1381.68	1348.74
Total MIMO Conducted Power (dBm/10MHz)		31.16	31.40	31.30
Ant. Gain (dBi)		6.00	6.00	6.00
e.i.r.p (dBm/10MHz)		37.16	37.40	37.30
e.i.r.p Limit(dBm/10MHz)		47.00	47.00	47.00
Margin (dB)		-9.84	-9.60	-9.70
High Channel	Port	QPSK	16QAM	64QAM
Conducted Power (dBm/10MHz)	0	28.69	28.71	28.57
	1	28.02	28.36	28.23
Total MIMO Conducted Power (mW/10MHz)		1375.47	1430.51	1386.72
Total MIMO Conducted Power (dBm/10MHz)		31.38	31.55	31.42
Ant. Gain (dBi)		6.00	6.00	6.00
e.i.r.p (dBm/10MHz)		37.38	37.55	37.42
e.i.r.p Limit(dBm/10MHz)		47.00	47.00	47.00
Margin (dB)		-9.62	-9.45	-9.58

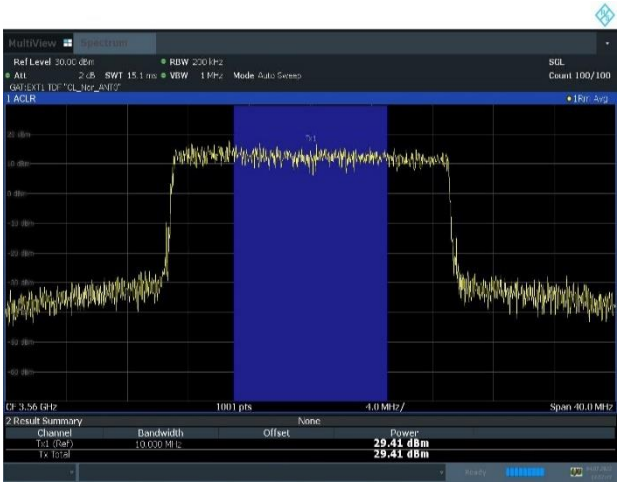
Table 8-7. Equivalent Isotropic Radiated Power Table (LTE_B48_20M)



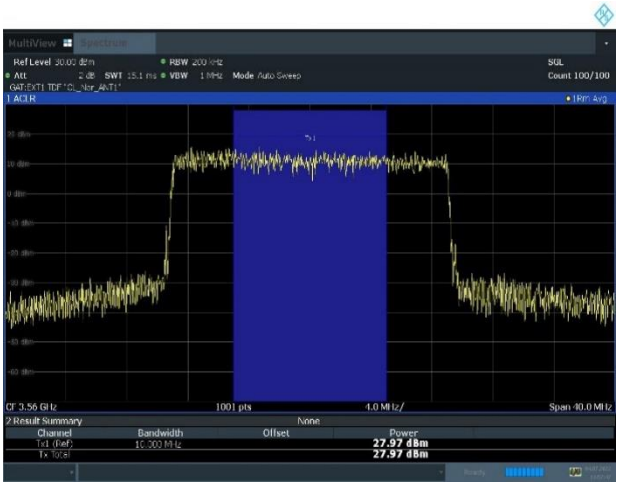
Plot 8-12. Equivalent Isotropic Radiated Power Plot
(LTE_B48_10M_64QAM – Mid Channel, Port 0)



Plot 8-13. Equivalent Isotropic Radiated Power Plot
(LTE_B48_10M_64QAM – Mid Channel, Port 1)



Plot 8-14. Equivalent Isotropic Radiated Power Plot
(LTE_B48_20M_16QAM - Low Channel, Port 0)



Plot 8-15. Equivalent Isotropic Radiated Power Plot
(LTE_B48_20M_16QAM - Low Channel, Port 1)

8.6 Peak To Average Power Ratio (PAPR)

Test Overview

A peak to average ratio measurement is performed at the conducted port of the EUT. The spectrum analyzers Complementary Cumulative Distribution Function (CCDF) measurement profile is used to determine the largest deviation between the average and the peak power of the EUT in a given bandwidth. The CCDF curve shows how much time the peak waveform spends at or above a given average power level. The percent of time the signal spends at or above the level defines the probability for that particular power level.

Test Procedure Used

KDB 971168 D01 v0301 - Section 5.7
ANSI C63.26 - Section 5.2.6

Test Setting

The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. The spectrum analyzer setting were as follows:

1. The signal analyzer's CCDF function is enabled.
2. Frequency = carrier center frequency
3. Measurement BW ≥ OBW or specified reference bandwidth
4. The signal analyzer was set to collect one million samples to generate the CCDF curve
5. The measurement interval was set depending on the type of signal analyzed. For continuous signals (>98% duty cycle), the measurement interval was set to 1ms.

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

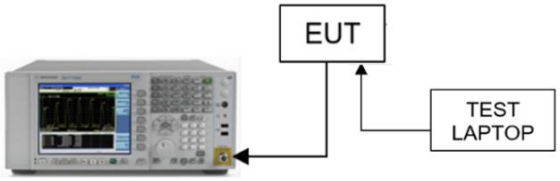


Figure 8-5. Test Instrument & Measurement Setup

Limit

Peak-to-average power ratio (PAPR) limit shall not exceed 13 dB for more than 0.1% of the time.

Test Notes

None.

Channel	Port	PAPR (dB)			Limit (dB)
		QPSK	16QAM	64QAM	
Low	0	9.70	9.74	9.74	≤ 13
	1	9.68	9.74	9.70	≤ 13
Middle	0	9.72	**9.80**	9.72	≤ 13
	1	9.74	9.66	9.74	≤ 13
High	0	9.70	9.72	9.70	≤ 13
	1	9.60	9.72	9.62	≤ 13

Table 8-8. Peak To Average Power Ratio Summary Data (LTE_B48_10M)

Channel	Port	PAPR (dB)			Limit (dB)
		QPSK	16QAM	64QAM	
Low	0	**8.82**	8.76	8.74	≤ 13
	1	8.82	8.66	8.68	≤ 13
Middle	0	8.80	8.74	8.74	≤ 13
	1	8.68	8.74	8.70	≤ 13
High	0	8.74	8.76	8.78	≤ 13
	1	8.74	8.64	8.70	≤ 13

Table 8-9. Peak To Average Power Ratio Summary Data (LTE_B48_20M)

Plot 8-16. Peak To Average Power Ratio Plot
(LTE_B48_10M_16QAM - Mid Channel, Port 0)

Plot 8-17. Peak To Average Power Ratio Plot
(LTE_B48_20M_QPSK - Low Channel, Port 0)

8.7 Channel Edge Emissions at Antenna Terminal

Test Overview

All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

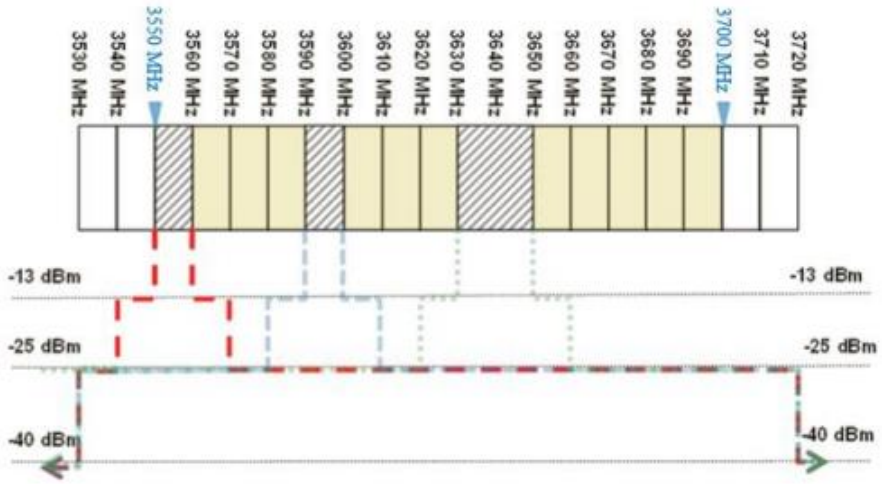
Test Procedure Used

KDB 971168 D01 v03r01 – Section 6
KDB 662911 D01 v02r01 – Section E)3) Out-of-Band and Spurious Emission Measurements
a) Absolute Emission Limits
iii) Measure and add 10 log(N_{ANT}) dB
ANSI C63.26-2015 – Section 5.7

Test Setting

1. Start and stop frequency were set such that the Channel Edge would be placed in the center of the plot
2. Span was set large enough so as to capture all out of band emissions near the Channel Edge
3. RBW: 1% of fundamental for measurements within 1 MHz immediately outside the authorized channel
   1 MHz for beyond 1 MHz outside the authorized channel.
4. VBW ≥ 3 x RBW
5. Detector = RMS
6. Number of sweep points ≥ 2 x Span/RBW
7. Trace mode = trace average
8. Sweep time = auto couple
9. The trace was allowed to stabilize

Limit



- Within 0 MHz to 10 MHz above and below the assigned channel ≤ −13 dBm/MHz
- Greater than 10 MHz above and below the assigned channel ≤ −25 dBm/MHz
- Any emission below 3530 MHz and above 3720 MHz ≤ −40 dBm/MHz

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

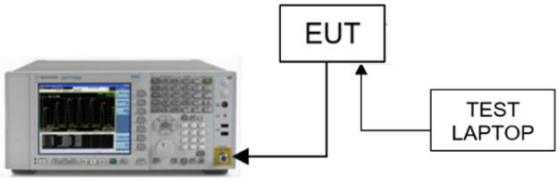


Figure 8-6. Test Instrument & Measurement Setup

Test Notes

1. All the measurement has been tested but test table result, and test plots are referred from the worst of value of each of modulation of each antenna ports.

2. Periodic trigger was used with gating ON. Gate sweeptime, Gate delay and gate length were set accordingly to capture ON time of the transmission.

3. Per Section 96.41(e)(3)—resolution bandwidth 1% of fundamental for measurements within 1 MHz immediately outside the authorized channel; and 1 MHz for beyond 1 MHz outside the authorized channel.

4. The limits were adjusted by a factor of [-10*log (2)] dB to account for the device operation as a 2 port MIMO transmitter, as per FCC KDB 622911. MIMO Factor calculation as below:
   MIMO Factor = 10*log (2) = 3.01 dB

Frequency range	Basic Limit (dBm/MHz)	MIMO Factor (dB)	RBW Factor (dB)	Adjusted limit (dBm)
0 MHz to 10 MHz above and below the assigned channel	-13	3.01	-	-16.01
10 MHz above and below the assigned channel	-25	3.01	-	-28.01
below 3530 MHz and above 3720 MHz	-40	3.01	-	-43.01
Note: Adjusted limit (dBm/MHz) = Basic limit (dBm/1MHz) - MIMO Factor				

5. Narrower RBW parameter is applied according to Section 5.7 of ANSI C63.26-2015 for some edge channels due to improving measurement accuracy. RBW Factor calculation as below:
   RBW Factor = 10*log (1/0.1) = 10 dB for below Frequency range

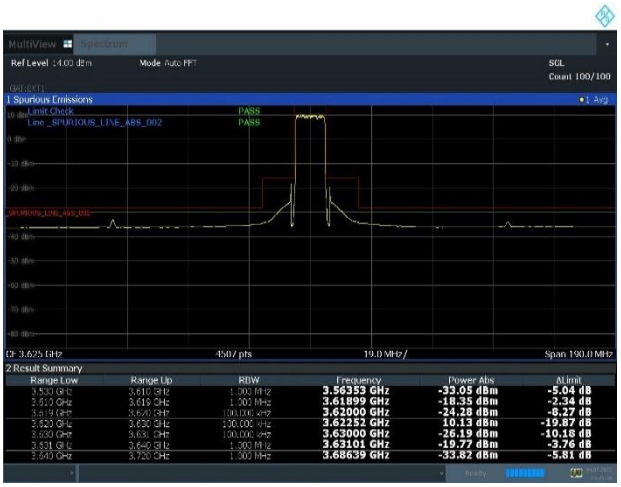
Frequency range	Basic Limit (dBm/MHz)	MIMO Factor (dB)	RBW Factor (dB)	Adjusted limit (dBm)
3580 to 3720	-25	3.01	10	-38.01

Channel	Port	Measured Range (GHz)	Max. Value (dBm)			Limit (dBm)	Worst Margin(dB)
			QPSK	16QAM	64QAM		
Low	0	3530 to 3540	-34.81	-34.86	-34.87	-28.01	-6.80
	0	3540 to 3549	-19.04	-18.65	-18.76	-16.01	-2.64
	0	3549 to 3550	-25.63	-24.60	-25.74	-16.01	-8.59
	0	3560 to 3561	-27.46	-26.78	-24.47	-16.01	-8.46
	0	3561 to 3570	-19.90	-20.10	-19.81	-16.01	-3.80
	0	3570 to 3720	-34.10	-33.76	-34.37	-28.01	-5.75
	1	3540 to 3549	-34.22	-34.18	-34.22	-28.01	-6.17
	1	3549 to 3550	-19.12	-18.78	-19.06	-16.01	-2.77
	1	3560 to 3561	-25.97	-24.94	-26.04	-16.01	-8.93
	1	3561 to 3570	-27.19	-26.31	-24.27	-16.01	-8.26
	1	3570 to 3720	-19.80	-19.87	-19.80	-16.01	-3.79
	1	3530 to 3540	-33.78	-33.73	-33.63	-28.01	-5.62
Mid	0	3530 to 3610	-33.54	**-33.05**	-32.98	-28.01	-4.97
	0	3610 to 3619	-18.81	**-18.35**	-18.58	-16.01	**-2.34**
	0	3619 to 3620	-25.47	**-24.28**	-25.21	-16.01	-8.27
	0	3630 to 3631	-26.76	**-26.19**	-24.21	-16.01	-8.20
	0	3631 to 3640	-19.43	**-19.77**	-19.55	-16.01	-3.42
	0	3640 to 3720	-34.22	**-33.82**	-34.12	-28.01	-5.81
	1	3530 to 3610	-33.69	-33.78	-33.82	-28.01	-5.68
	1	3610 to 3619	-18.87	-18.77	-18.97	-16.01	-2.76
	1	3619 to 3620	-25.52	-25.00	-25.82	-16.01	-8.99
	1	3630 to 3631	-26.83	-26.59	-24.55	-16.01	-8.54
	1	3631 to 3640	-19.64	-20.33	-19.89	-16.01	-3.63
	1	3640 to 3720	-33.45	-33.76	-33.71	-28.01	-5.44
High	0	3530 to 3680	-33.44	-33.45	-33.60	-28.01	-5.43
	0	3680 to 3689	-19.21	-18.69	-18.63	-16.01	-2.62
	0	3689 to 3690	-25.79	-24.31	-25.40	-16.01	-8.30
	0	3700 to 3701	-27.01	-26.07	-24.03	-16.01	-8.02
	0	3701 to 3710	-19.57	-19.47	-19.46	-16.01	-3.45
	0	3710 to 3720	-34.91	-34.79	-34.86	-28.01	-6.78
	1	3530 to 3680	-33.37	-33.45	-33.47	-16.01	-5.36
	1	3680 to 3689	-19.18	-18.94	-18.89	-16.01	-2.88
	1	3689 to 3690	-25.71	-24.55	-25.55	-16.01	-8.54
	1	3700 to 3701	-27.13	-26.77	-24.84	-16.01	-8.83
	1	3701 to 3710	-19.80	-20.20	-20.18	-16.01	-3.79
	1	3710 to 3720	-34.15	-34.33	-34.30	-28.01	-6.14

Table 8-10. Channel Edge Emission Summary Data (LTE_B48_10M)

Channel	Port	Measured Range (GHz)	Max. Value (dBm)			Limit (dBm)	Worst Margin(dB)
			QPSK	16QAM	64QAM		
Low	0	3530 to 3540	-30.52	-30.58	-30.51	-28.01	-2.50
	0	3540 to 3549	-23.88	-24.06	-24.05	-16.01	-7.87
	0	3549 to 3550	-30.11	-30.48	-30.50	-16.01	-14.10
	0	3570 to 3571	-30.26	-30.09	-30.01	-16.01	-14.00
	0	3571 to 3580	-23.78	-23.84	-23.78	-16.01	-7.77
	0	3580 to 3720	-40.05	-39.52	-39.87	-38.01	-1.51
	1	3530 to 3540	**-30.95**	-30.93	-30.88	-28.01	-2.87
	1	3540 to 3549	**-24.02**	-24.38	-24.30	-16.01	-8.01
	1	3549 to 3550	**-30.31**	-30.95	-30.78	-16.01	-14.30
	1	3570 to 3571	**-30.92**	-31.04	-30.85	-16.01	-14.84
	1	3571 to 3580	**-24.37**	-24.45	-24.45	-16.01	-8.36
	1	3580 to 3720	**-38.99**	-39.16	-39.10	-38.01	**-0.98**
Mid	0	3530 to 3600	-29.59	-29.82	-29.91	-28.01	-1.58
	0	3600 to 3609	-24.06	-24.44	-24.39	-16.01	-8.05
	0	3609 to 3610	-30.67	-30.96	-30.82	-16.01	-14.66
	0	3630 to 3631	-30.95	-31.31	-31.17	-16.01	-14.94
	0	3631 to 3640	-24.22	-24.86	-24.79	-16.01	-8.21
	0	3640 to 3720	-29.34	-29.38	-29.45	-28.01	-1.33
	1	3530 to 3600	-29.91	-29.71	-29.92	-28.01	-1.70
	1	3600 to 3609	-24.35	-24.49	-24.68	-16.01	-8.34
	1	3609 to 3610	-30.97	-30.96	-31.23	-16.01	-14.95
	1	3630 to 3631	-31.27	-31.01	-31.43	-16.01	-15.00
	1	3631 to 3640	-24.71	-24.72	-25.07	-16.01	-8.70
	1	3640 to 3720	-29.65	-29.04	-29.35	-28.01	-1.03
High	0	3530 to 3660	-29.89	-29.82	-30.46	-28.01	-1.81
	0	3660 to 3669	-24.28	-24.75	-24.67	-16.01	-8.27
	0	3669 to 3670	-30.34	-31.18	-30.84	-16.01	-14.33
	0	3690 to 3691	-31.19	-30.98	-30.76	-16.01	-14.75
	0	3691 to 3700	-24.46	-24.56	-24.39	-16.01	-8.38
	0	3700 to 3720	-29.64	-29.64	-30.15	-28.01	-1.63
	1	3530 to 3660	-29.98	-29.91	-30.61	-16.01	-1.90
	1	3660 to 3669	-25.00	-24.73	-25.18	-16.01	-8.72
	1	3669 to 3670	-31.63	-31.32	-31.63	-16.01	-15.31
	1	3690 to 3691	-31.67	-31.36	-31.19	-16.01	-15.18
	1	3691 to 3700	-24.84	-24.98	-24.76	-16.01	-8.75
	1	3700 to 3720	-30.19	-30.29	-30.22	-28.01	-2.18

Table 8-11. Channel Edge Emission Summary Data (LTE_B48_20M)



Plot 8-18. Channel Edge Emission Plot
(LTE_B48_10M_16QAM – Mid Channel, Port 0)

Plot 8-19. Channel Edge Emission Plot
(LTE_B48_20M_QPSK – Low Channel, Port 1)

8.8 Spurious and Harmonic Emissions at Antenna Terminal

Test Overview

The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10th harmonic. All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

Test Procedure Used

KDB 971168 D01 v03r01 – Section 6
KDB 662911 D01 v02r01 – Section E)3) Out-of-Band and Spurious Emission Measurements
a) Absolute Emission Limits
iii) Measure and add 10 log(N_{ANT}) dB
ANSI C63.26-2015 – Section 5.7

Test Setting

1. Start frequency was set to 30 MHz and stop frequency was set to at least 10 * the fundamental frequency excluding the frequency range of the Channel Edge measurement.
2. RBW: 1 MHz
3. VBW ≥ 3 x RBW
4. Detector = RMS
5. Number of sweep points ≥ 2 x Span/RBW
6. Trace mode = trace average
7. Sweep time = auto couple
8. The trace was allowed to stabilize

Limit

- Any emission below 3530 MHz and above 3720 MHz ≤ −40 dBm/MHz

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

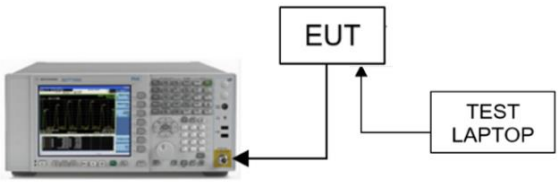


Figure 8-7. Test Instrument & Measurement Setup

Test Notes

1. All the measurement has been tested but test table result, and test plots are referred from the worst of value of each of modulation of each antenna ports.

2. When detected Emission, this value has been applied as reference offset in the spectrum analyzer.
   Duty cycle correction factor was added to spectrum analyzer.
   Duty cycle = transmit on-time / transmitter period = 3.78 ms / 5 ms = 0.76
   Duty cycle correction factor = 10*log (1/duty cycle) =10*log (1/0.76) = 1.21 dB

3. The limits were adjusted by a factor of [-10*log (2)] dB to account for the device operation as a 2 port MIMO transmitter, as per FCC KDB 622911. MIMO Factor calculation as below:
   MIMO Factor = 10*log (2) = 3.01 dB

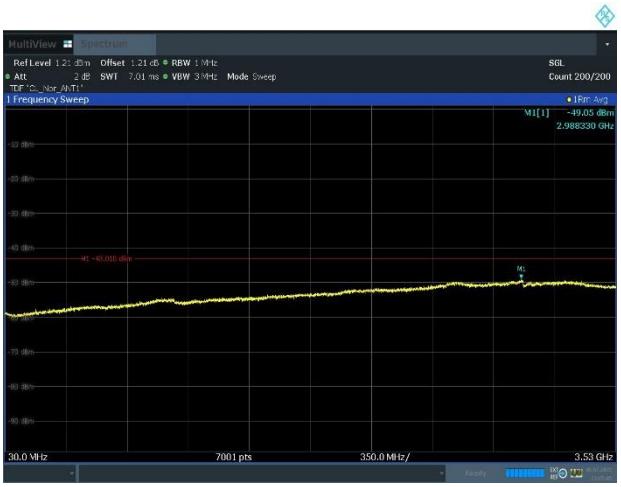
Frequency range	Basic Limit (dBm/MHz)	MIMO Factor (dB)	RBW Factor (dB)	Adjusted limit (dBm)
below 3530 MHz and above 3720 MHz	-40	3.01	-	-43.01
Note: Adjusted limit (dBm/MHz) = Basic limit (dBm/1MHz) - MIMO Factor				

Channel	Port	Measurement Range	Level (dBm)			Limit (dBm)	Worst Margin (dB)
			QPSK	16QAM	64QAM		
Low	0	30 MHz to 3530 MHz	-50.12	-50.23	-50.31	-43.01	-7.11
		3.72 GHz to 6 GHz	-46.78	-46.96	-46.93	-43.01	-3.77
		6 GHz to 18 GHz	-66.74	-66.58	-66.58	-43.01	-23.57
		18 GHz to 40 GHz	-46.46	-46.26	-46.30	-43.01	-3.25
	1	30 MHz to 3530 MHz	**-49.05**	-49.11	-49.08	-43.01	-6.04
		3.72 GHz to 6 GHz	**-45.61**	-46.03	-45.73	-43.01	**-2.60**
		6 GHz to 18 GHz	**-67.04**	-67.17	-67.05	-43.01	-24.03
		18 GHz to 40 GHz	**-47.87**	-47.87	-48.00	-43.01	-4.86
Middle	0	30 MHz to 3530 MHz	-50.22	-50.27	-50.39	-43.01	-7.21
		3.72 GHz to 6 GHz	-46.73	-46.79	-46.94	-43.01	-3.72
		6 GHz to 18 GHz	-66.78	-66.65	-66.67	-43.01	-23.64
		18 GHz to 40 GHz	-46.29	-46.17	-46.28	-43.01	-3.16
	1	30 MHz to 3530 MHz	-49.22	-49.26	-49.31	-43.01	-6.21
		3.72 GHz to 6 GHz	-45.65	-45.77	-45.81	-43.01	-2.64
		6 GHz to 18 GHz	-66.80	-67.01	-67.18	-43.01	-23.79
		18 GHz to 40 GHz	-47.93	-48.01	-48.00	-43.01	-4.92
High	0	30 MHz to 3530 MHz	-50.38	-50.24	-50.13	-43.01	-7.12
		3.72 GHz to 6 GHz	-46.75	-46.95	-46.77	-43.01	-3.74
		6 GHz to 18 GHz	-66.75	-66.75	-66.72	-43.01	-23.71
		18 GHz to 40 GHz	-46.42	-46.39	-46.23	-43.01	-3.22
	1	30 MHz to 3530 MHz	-49.08	-49.04	-49.23	-43.01	-6.03
		3.72 GHz to 6 GHz	-45.84	-45.87	-45.74	-43.01	-2.73
		6 GHz to 18 GHz	-67.29	-67.15	-67.01	-43.01	-24.00
		18 GHz to 40 GHz	-47.93	-47.85	-47.92	-43.01	-4.84

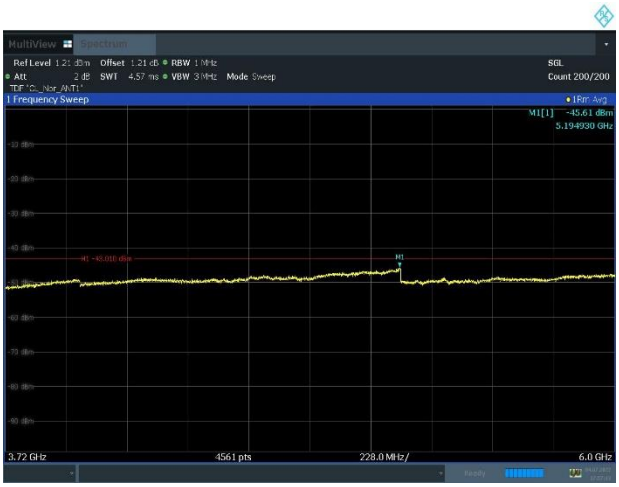
Table 8-12. Conducted Spurious Emission Summary Data (LTE_B48_10M)

Channel	Port	Measurement Range	Level (dBm)			Limit (dBm)	Worst Margin (dB)
			QPSK	16QAM	64QAM		
Low	0	30 MHz to 3530 MHz	-50.25	-50.22	-50.31	-43.01	-7.21
		3.72 GHz to 6 GHz	-46.48	-46.73	-46.86	-43.01	-3.47
		6 GHz to 18 GHz	-66.60	-66.60	-66.61	-43.01	-23.59
		18 GHz to 40 GHz	-46.25	-46.24	-46.41	-43.01	-3.23
	1	30 MHz to 3530 MHz	-49.37	-49.29	**-49.38**	-43.01	-6.28
		3.72 GHz to 6 GHz	-46.11	-46.00	**-45.63**	-43.01	**-2.62**
		6 GHz to 18 GHz	-67.20	-67.11	**-67.16**	-43.01	-24.10
		18 GHz to 40 GHz	-47.66	-47.92	**-47.94**	-43.01	-4.65
Middle	0	30 MHz to 3530 MHz	-50.23	-50.24	-50.23	-43.01	-7.22
		3.72 GHz to 6 GHz	-46.88	-46.73	-46.78	-43.01	-3.72
		6 GHz to 18 GHz	-66.69	-66.57	-66.63	-43.01	-23.56
		18 GHz to 40 GHz	-46.43	-46.48	-46.34	-43.01	-3.33
	1	30 MHz to 3530 MHz	-49.35	-49.36	-49.30	-43.01	-6.29
		3.72 GHz to 6 GHz	-46.13	-46.08	-46.31	-43.01	-3.07
		6 GHz to 18 GHz	-67.22	-67.16	-67.13	-43.01	-24.12
		18 GHz to 40 GHz	-48.06	-47.80	-47.86	-43.01	-4.79
High	0	30 MHz to 3530 MHz	-50.17	-49.96	-50.18	-43.01	-6.95
		3.72 GHz to 6 GHz	-47.04	-46.85	-46.84	-43.01	-3.83
		6 GHz to 18 GHz	-66.67	-66.74	-66.60	-43.01	-23.59
		18 GHz to 40 GHz	-46.34	-46.37	-46.40	-43.01	-3.33
	1	30 MHz to 3530 MHz	-49.27	-49.38	-49.37	-43.01	-6.26
		3.72 GHz to 6 GHz	-46.00	-46.10	-46.14	-43.01	-2.99
		6 GHz to 18 GHz	-67.24	-67.17	-67.15	-43.01	-24.14
		18 GHz to 40 GHz	-47.86	-47.86	-48.04	-43.01	-4.85

Table 8-13. Conducted Spurious Emission Summary Data (LTE_B48_20M)

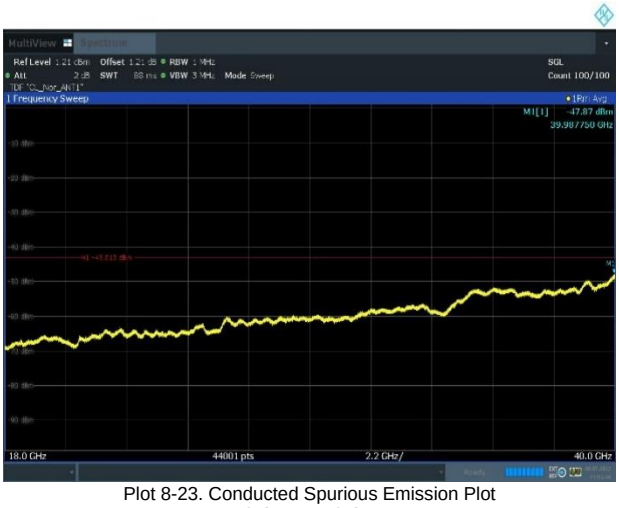


Plot 8-20. Conducted Spurious Emission Plot
30 MHz to 3530 MHz
(LTE_B48_10M_QPSK - Low Channel, Port 1)

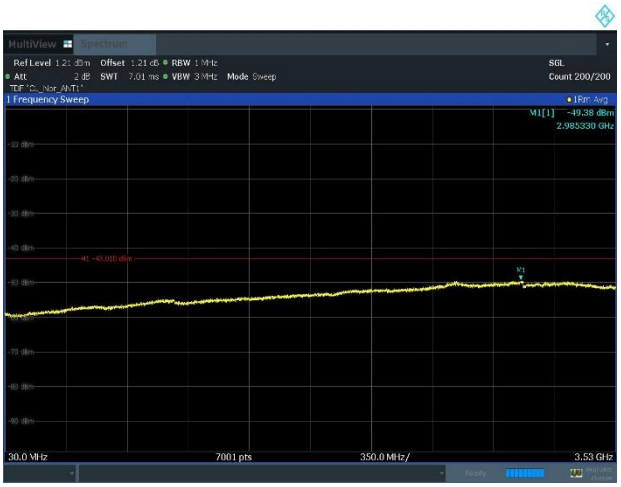


Plot 8-21. Conducted Spurious Emission Plot
3.72 MHz to 6 GHz
(LTE_B48_10M_QPSK - Low Channel, Port 1)

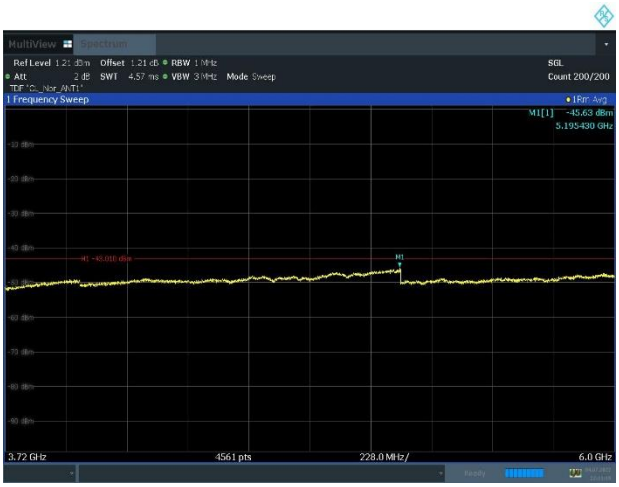
Plot 8-22. Conducted Spurious Emission Plot
6 GHz to 18 GHz
(LTE_B48_10M_QPSK - Low Channel, Port 1)



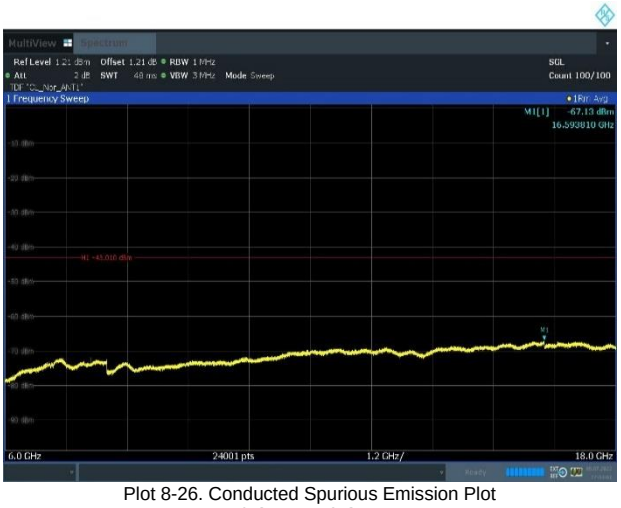
Plot 8-23. Conducted Spurious Emission Plot
18 GHz to 40 GHz
(LTE_B48_10M_QPSK - Low Channel, Port 1)



Plot 8-24. Conducted Spurious Emission Plot
30 MHz to 3530 MHz
(LTE_B48_20M_64QAM - Low Channel, Port 1)



Plot 8-25. Conducted Spurious Emission Plot
3.72 MHz to 6 GHz
(LTE_B48_20M_64QAM - Low Channel, Port 1)



Plot 8-26. Conducted Spurious Emission Plot
6 GHz to 18 GHz
(LTE_B48_20M_64QAM - Low Channel, Port 1)

Plot 8-27. Conducted Spurious Emission Plot
18 GHz to 40 GHz
(LTE_B48_20M_64QAM - Low Channel, Port 1)

8.9 Radiated spurious emission

Test Overview

Radiated spurious emissions measurements are performed using the field strength method described in ANSI C63.26-2015 with the EUT transmitting into an integral antenna. Measurements on signals operating below 1GHz are performed using vertically and horizonally polarized broadband trilog antennas. Measurements on signals operating above 1GHz are performed using vertically and horizontally polarized broadband horn antennas.

Test Procedure Used

KDB 971168 D01 v03r01 - Section 7
ANSI C63.26 - Section 5.5

Test Setting

1. Start frequency was set to 30 MHz and stop frequency was set to at least 10 * the fundamental frequency
2. RBW = 1 MHz
3. VBW ≥ 3 x RBW
4. No. of sweep points ≥ 2 x span / RBW
5. Detector = RMS
6. Trace mode = Max Hold (In cases where the level is within 2 dB of the limit, the final measurement is taken using triggering/gating and trace averaging.)
7. The trace was allowed to stabilize.

Limit

- Within 0 MHz to 10 MHz above and below the assigned channel ≤ −13 dBm/MHz
- Greater than 10 MHz above and below the assigned channel ≤ −25 dBm/MHz
- Any emission below 3530 MHz and above 3720 MHz ≤ −40 dBm/MHz

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

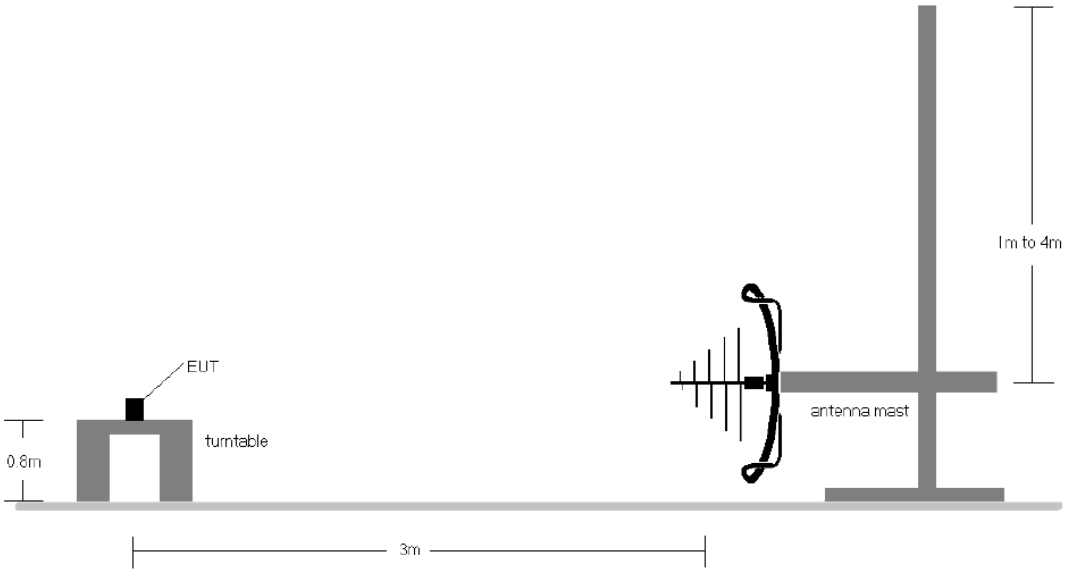


Figure 8-8. Test Instrument & Measurement Setup < 1GHz

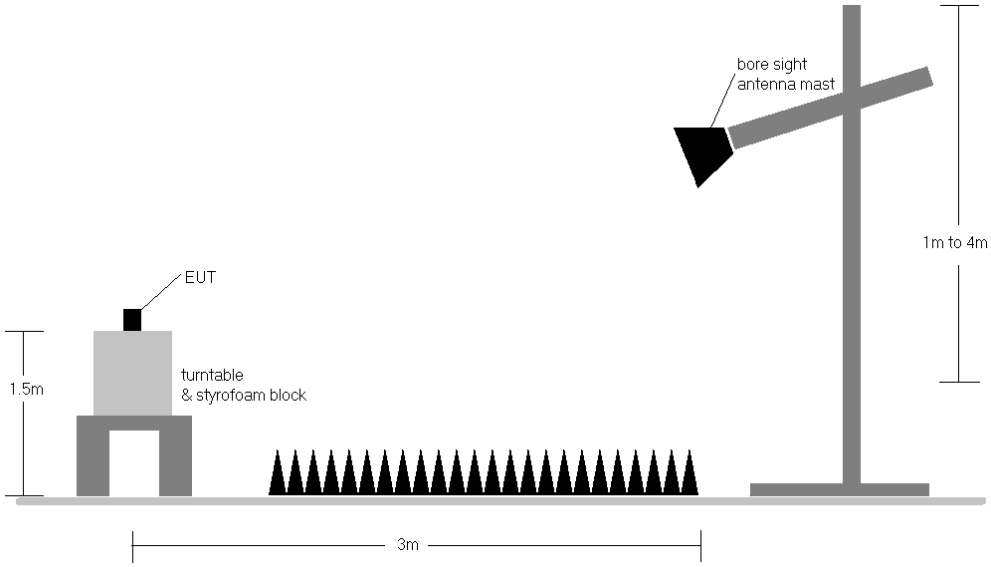


Figure 8-9. Test Instrument & Measurement Setup > 1GHz

Test Notes

1. The average EIRP reported below is calculated per 5.2.7 of ANSI C63.26-2015 which states:

   The measured e.i.r.p is converted to E-field in V/m. Then the distance correction is applied before converted back to calculated e.i.r.p.as explained in KDB 971168 D01 D01 v03r01.

Effective Isotropic Radiated Power Sample Calculation

Field Strength [dBµV/m] = Measured Value [dBm] + AFCL [dB/m] + 107

= -75.32 dBm + (11.78 dBm) + 107 = 43.46 dBµV/m

e.i.r.p. [dBm] = E[dB μV/m] + 20 $\log_{10}$(d[m]) - 104.8

= 43.46 + (20*log (3)) - 104.8

= -51.80 dBm e.i.r.p.

*AFCL (dB/m) contains measurement antenna factor(dB/m) and cable loss(dB) as below:

Frequency [MHz]	Antenna Factor (dB/m)	Cable loss + PAM [dB]	AFCL (dB/m)
35.26	11.29	0.49	11.78
17841.37	46.45	-22.97	23.48

Table 8-14. Adopted AFCL value in the calculation

2. The EUT was tested in both horizontal and vertical antenna polarizations and in all possible test configurations and positioning. The worst case emissions are reported with the EUT positioning, modulations, channel bandwidth configurations shown in the tables below.

3. The spectrum is measured from 30 MHz to the 10th harmonic of the fundamental frequency of the transmitter. The worst-case emissions are reported.

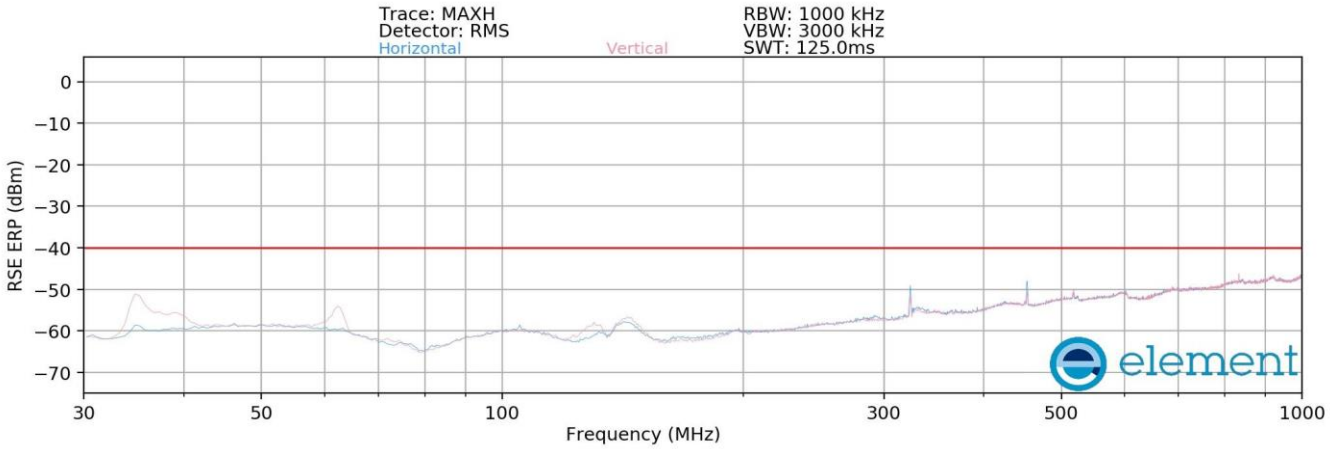
4. All emissions were measured at a 3 meter test distance.

5. Spurious emissions were measured with all EUT antennas transmitting simultaneously and all antenna ports terminated

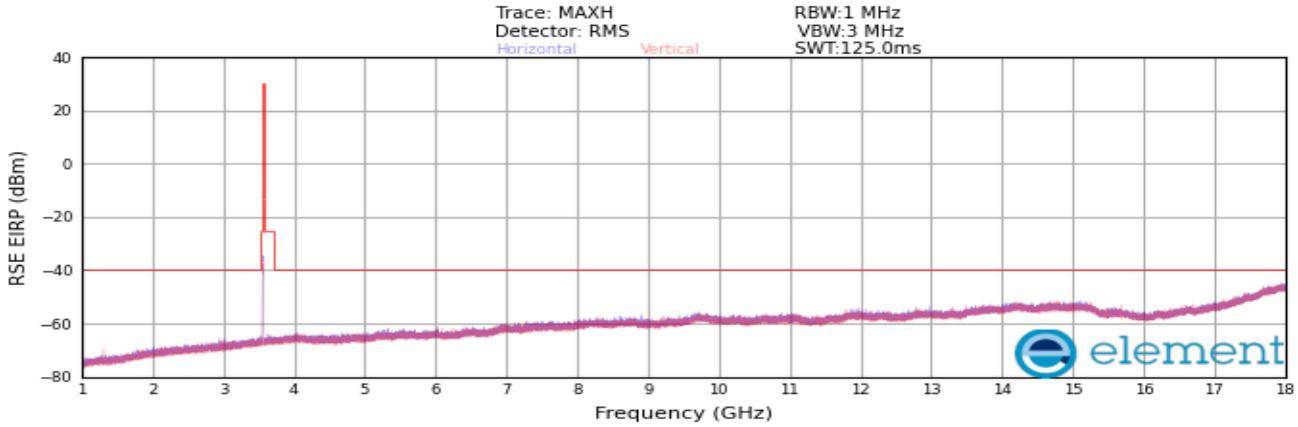
6. The "-" shown in the following RSE tables are used to denote a noise floor measurement.

7. All modes of operation were investigated and the worst case configuration results are reported in this section.

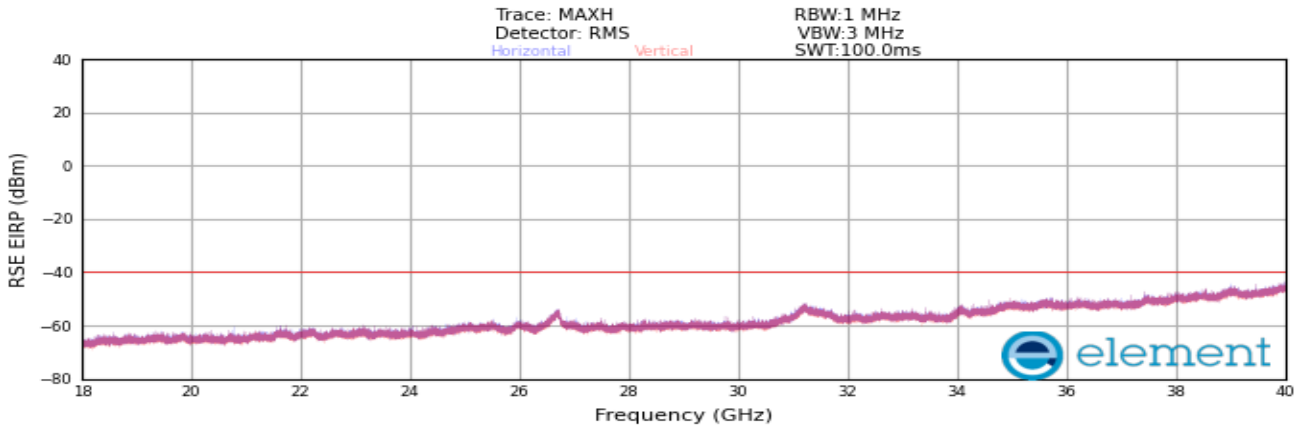
External power source Mode



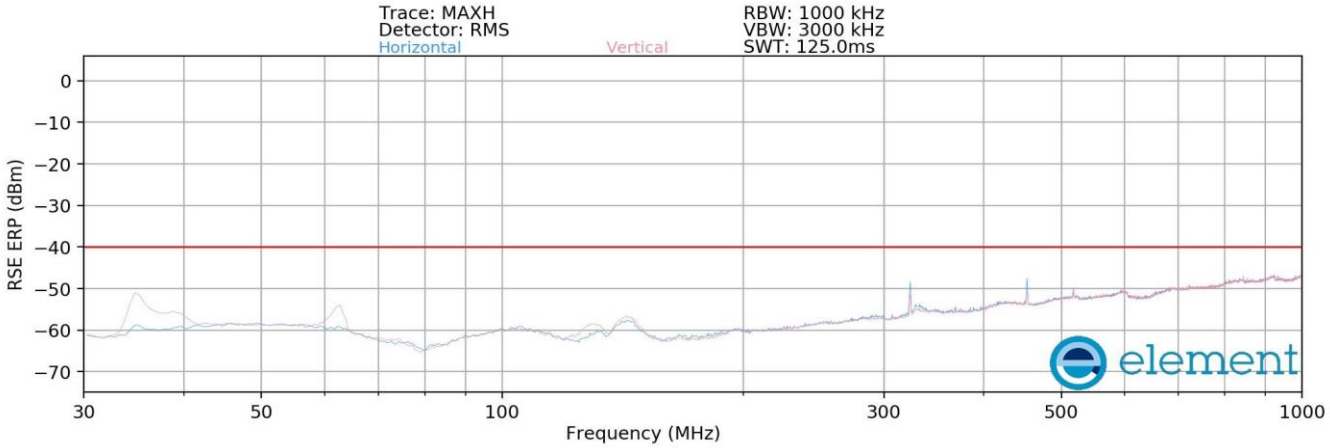
Plot 8-28. Radiated spurious emission Plot_30 MHz to 1000 MHz (LTE_B48_20M_QPSK - Low Channel)



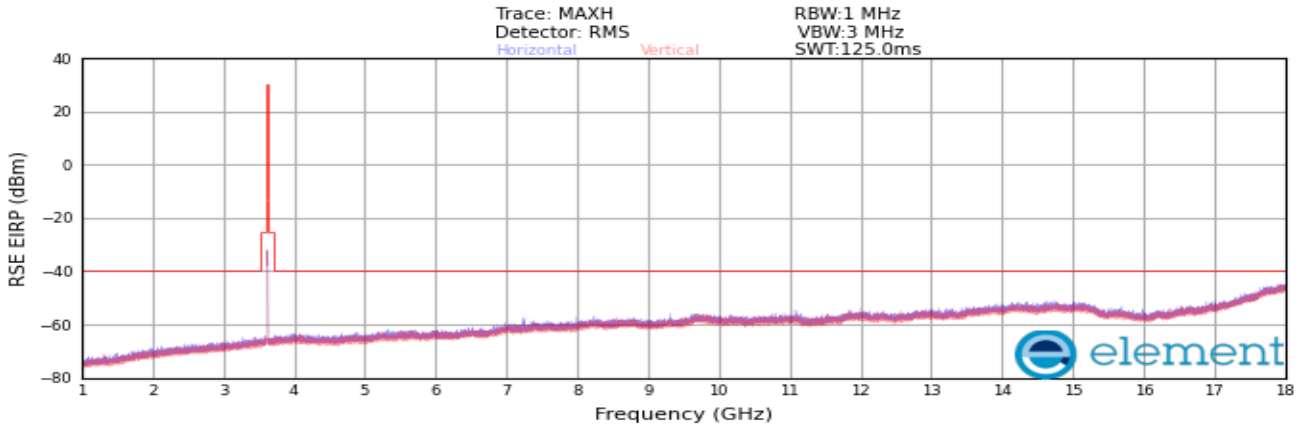
Plot 8-29. Radiated spurious emission Plot_1 GHz to 18 GHz (LTE_B48_20M_QPSK - Low Channel)



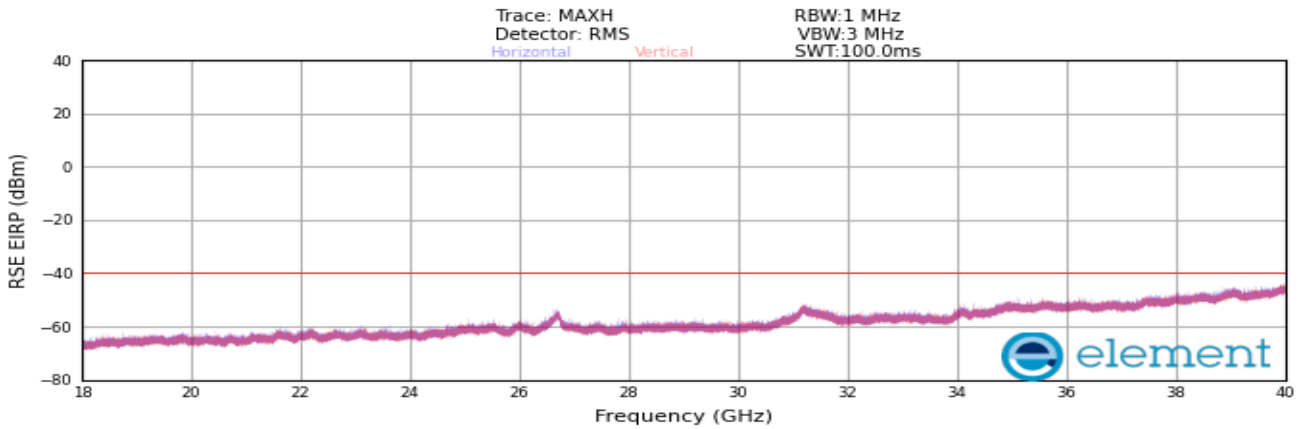
Plot 8-30. Radiated spurious emission Plot_18 GHz to 40 GHz (LTE_B48_20M_QPSK - Low Channel)



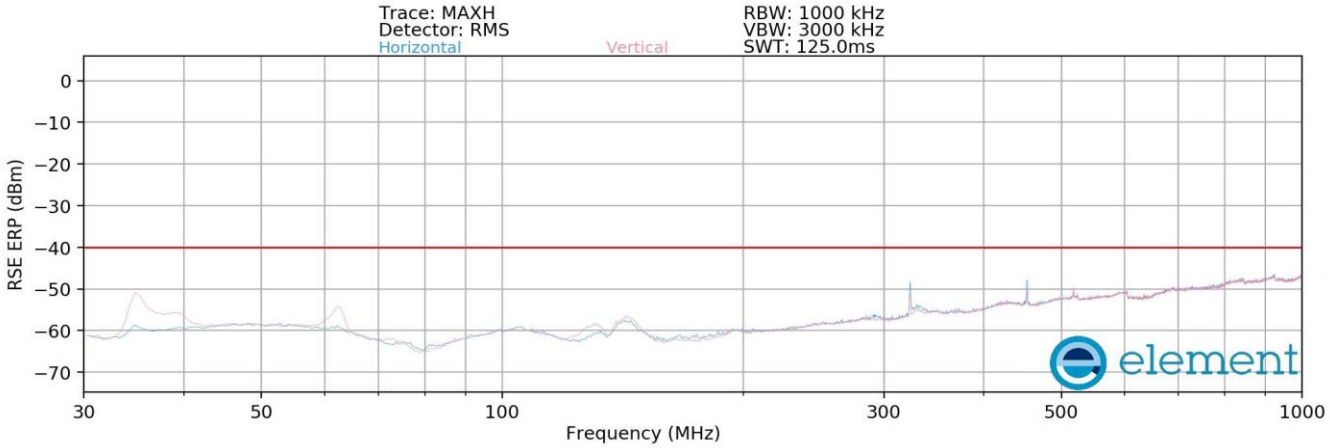
Plot 8-31. Radiated spurious emission Plot_30 MHz to 1000 MHz (LTE_B48_20M_QPSK - Mid Channel)



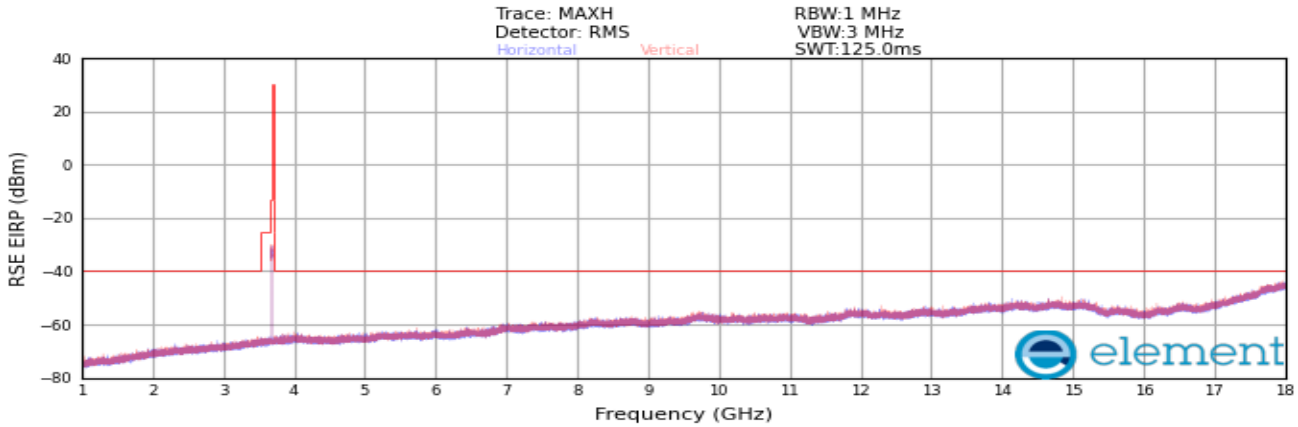
Plot 8-32. Radiated spurious emission Plot_1 GHz to 18 GHz (LTE_B48_20M_QPSK - Mid Channel)



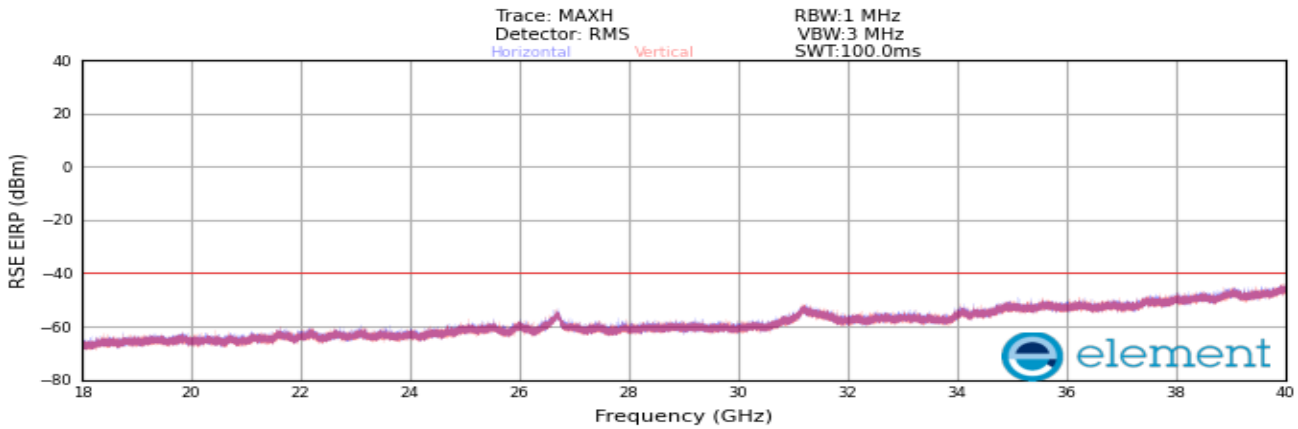
Plot 8-33. Radiated spurious emission Plot_18 GHz to 40 GHz (LTE_B48_20M_QPSK - Mid Channel)



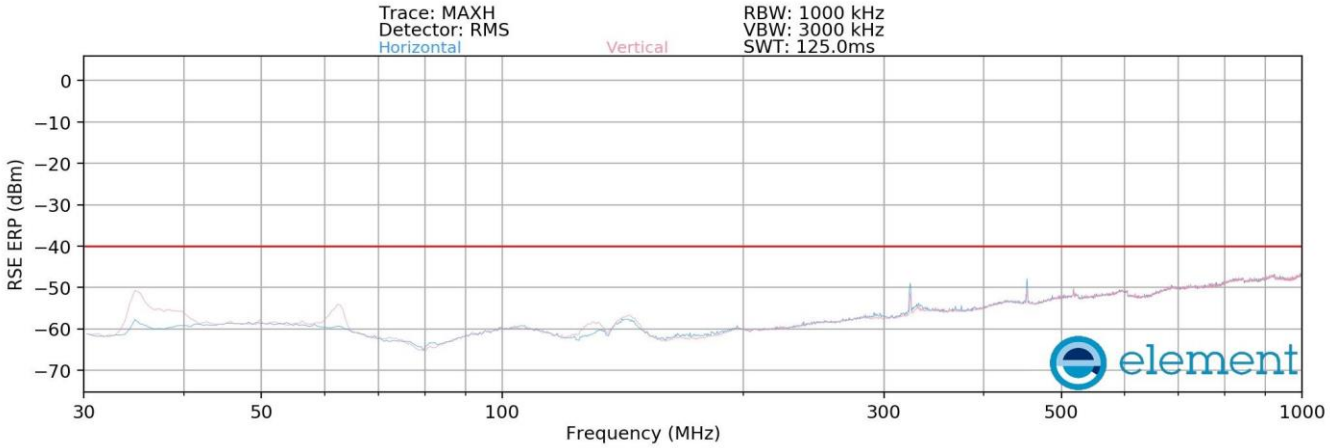
Plot 8-34. Radiated spurious emission Plot_30 MHz to 1000 MHz (LTE_B48_20M_QPSK - High Channel)



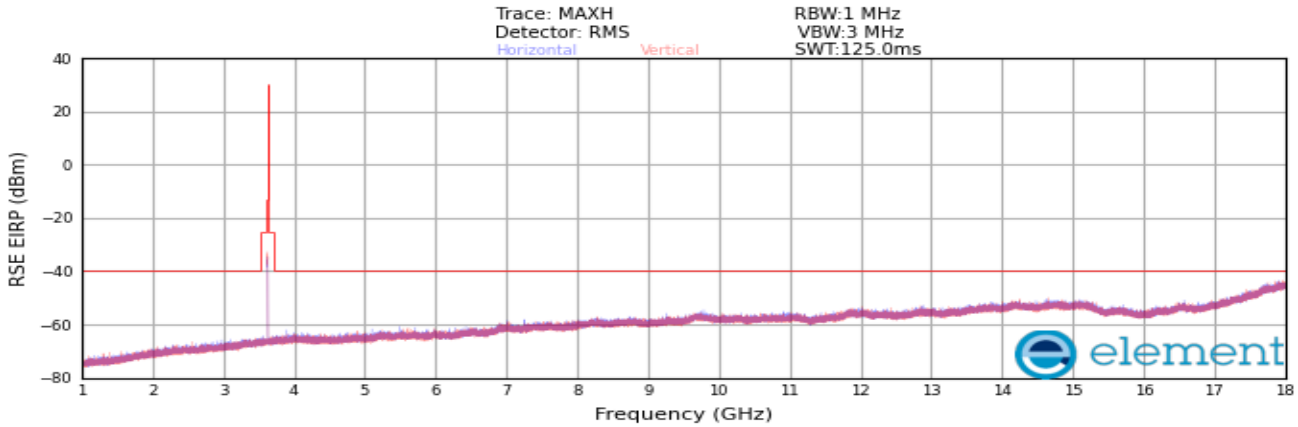
Plot 8-35. Radiated spurious emission Plot_1 GHz to 18 GHz (LTE_B48_20M_QPSK - High Channel)



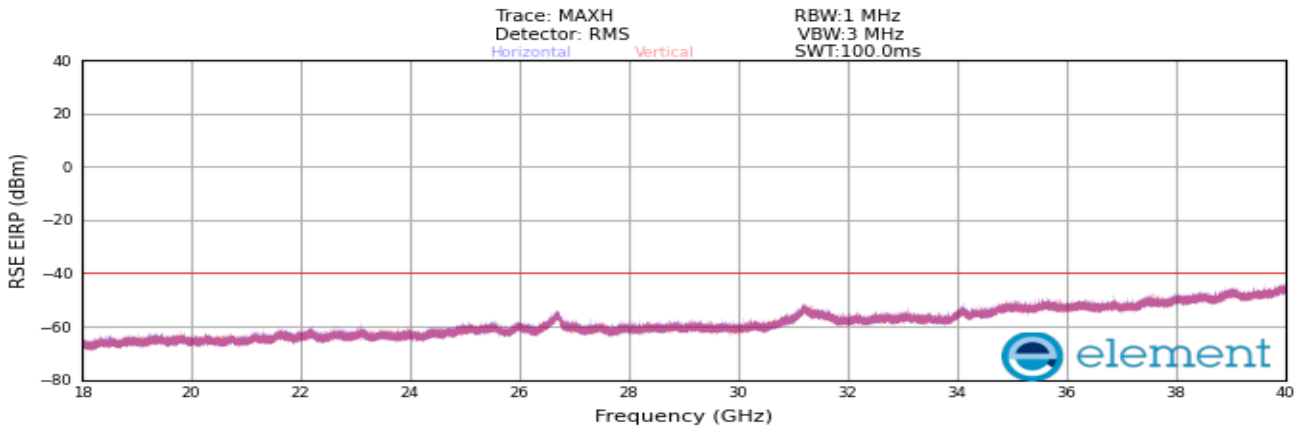
Plot 8-36. Radiated spurious emission Plot_18 GHz to 40 GHz (LTE_B48_20M_QPSK - High Channel)



Plot 8-37. Radiated spurious emission Plot_30 MHz to 1000 MHz (LTE_B48_10M_QPSK - Mid Channel)

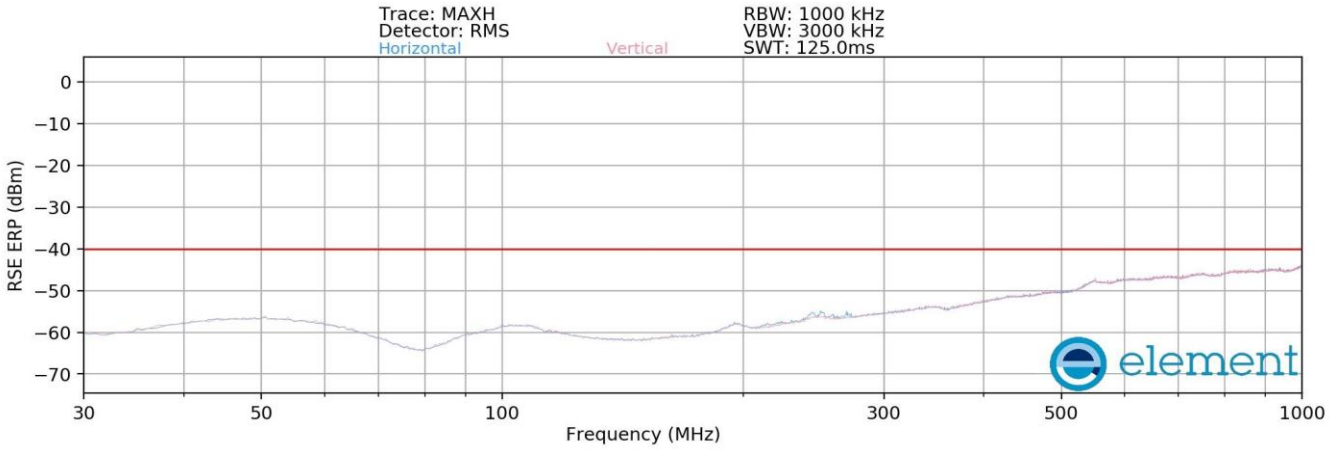


Plot 8-38. Radiated spurious emission Plot_1 GHz to 18 GHz (LTE_B48_10M_QPSK - Mid Channel)

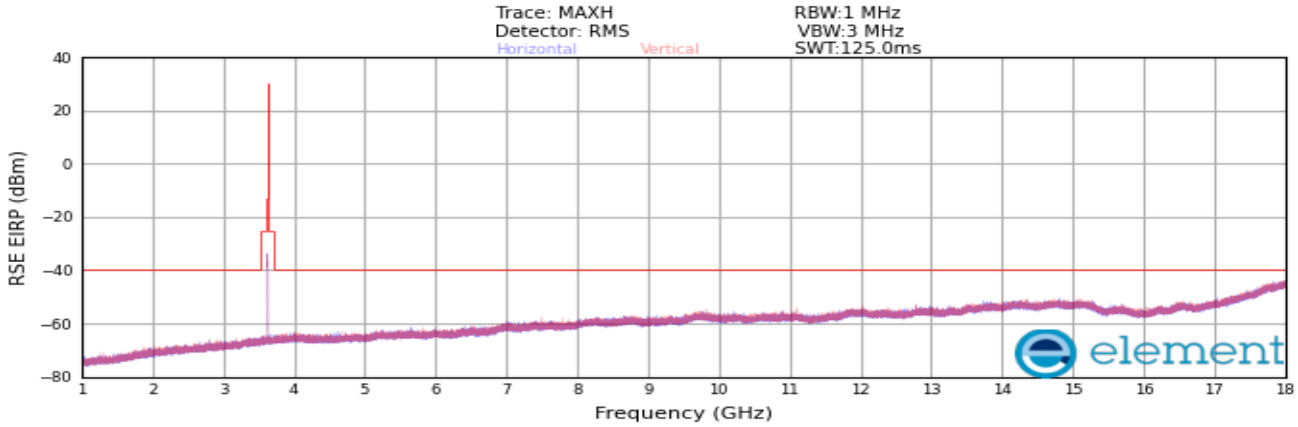


Plot 8-39. Radiated spurious emission Plot_18 GHz to 40 GHz (LTE_B48_10M_QPSK - Mid Channel)

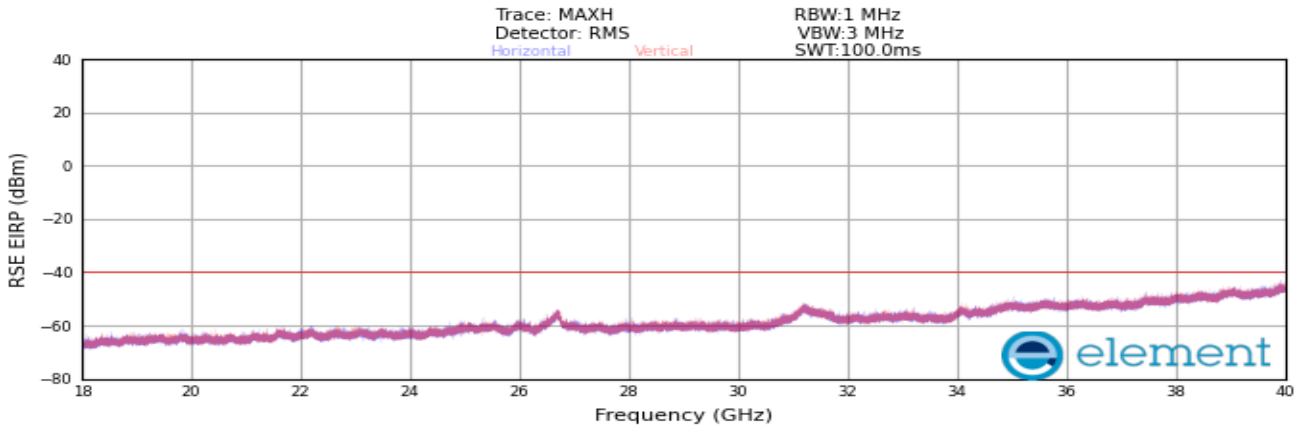
Battery Mode



Plot 8-40. Radiated spurious emission Plot_30 MHz to 1000 MHz (LTE_B48_10M_QPSK - Mid Channel)



Plot 8-41. Radiated spurious emission Plot_1 GHz to 18 GHz (LTE_B48_10M_QPSK - Mid Channel)



Plot 8-42. Radiated spurious emission Plot_18 GHz to 40 GHz (LTE_B48_10M_QPSK - Mid Channel)

Bandwidth (MHz):	LTE_B48_20M_QPSK - Low Channel
Frequency (MHz):	3560
Modulation Signal:	QPSK

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Heigh [cm]	Turntable azimuth [degree]	Analyzer Level [dBm/MHz]	AFCL [dBm]	Field Stength [dBµV/m]	RSE EIRP [dBm/MHz]	Limit [dBm/MHz]	Margin [dB]
35.26	V	110	60	-75.32	11.78	43.46	-51.80	-40.00	-11.80
458.73	V	110	80	-79.25	18.43	46.18	-49.07	-40.00	-9.07
992.53	H	150	120	-86.16	26.03	46.87	-47.58	-40.00	-7.58
17841.37	H	200	120	-79.15	23.48	51.33	-43.93	-40.00	-3.93

Table 8-15. Radiated spurious emission Worst case Data
(LTE_B48_20M_QPSK - Low Channel_ External power source)

8.10 Frequency Stability

Test Overview

Frequency stability testing is performed in accordance with the guidelines of KDB 971168 D01 v03r01.
The frequency stability of the transmitter is measured by:

a.) **Temperature:** The temperature is varied from -30°C, +20°C and +50°C using an environmental chamber.

b.) **Primary Supply Voltage:** The primary supply voltage is varied from 85% to 115% of the nominal value for DC powered equipment.

Test Procedure Used

ANSI C63.26 - Section 5.6
KDB 971168 D01 v03r01 - Section 9

Test setting

1. The carrier frequency of the transmitter is measured at room temperature (20°C to provide a reference).

2. The equipment is turned on in a "standby" condition for fifteen minutes before applying power to the transmitter. Measurement of the carrier frequency of the transmitter is made within one minute after applying power to the transmitter.

3. Frequency measurements are made -30°C, +20°C and +50°C. A period of at least one half-hour is provided to allow stabilization of the equipment at each temperature level.

Limit

The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Test Setup

The EUT was connected via an RF cable to a spectrum analyzer with the EUT placed inside an environmental chamber.

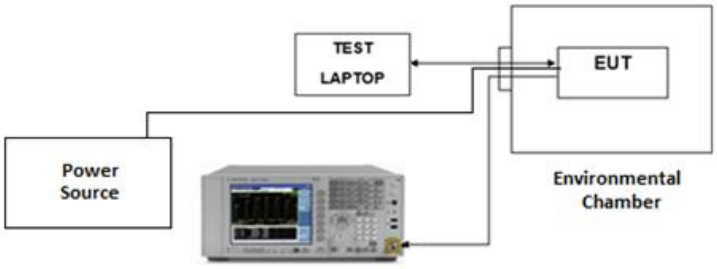


Figure 8-10. Test Instrument & Measurement Setup

Test Notes

None.

OPERATING FREQUENCY: 3,625,000,000 Hz

REFERENCE VOLTAGE: 24.00 VDC

VOLTAGE (%)	POWER (VDC)	TEMP (ºC)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	24.00	+ 20(Ref)	3,625,000,000	0	0.0000000
100 %		- 30	3,624,999,997	-3	-0.0000001
100 %		- 20	3,624,999,997	-3	-0.0000001
100 %		- 10	3,624,999,998	-2	0.0000000
100 %		0	3,624,999,999	-1	0.0000000
100 %		+ 10	3,624,999,997	-3	-0.0000001
100 %		+ 20	3,625,000,000	0	0.0000000
100 %		+ 30	3,625,000,001	1	0.0000000
100 %		+ 40	3,625,000,000	0	0.0000000
100 %		+ 50	3,625,000,002	2	0.0000001
85 %	20.40	+ 20	3,625,000,006	6	0.0000002
115 %	27.60	+ 20	3,625,000,000	0	0.0000000

Table 8-16. Frequency Stability Summary Data (LTE_B48_10M)

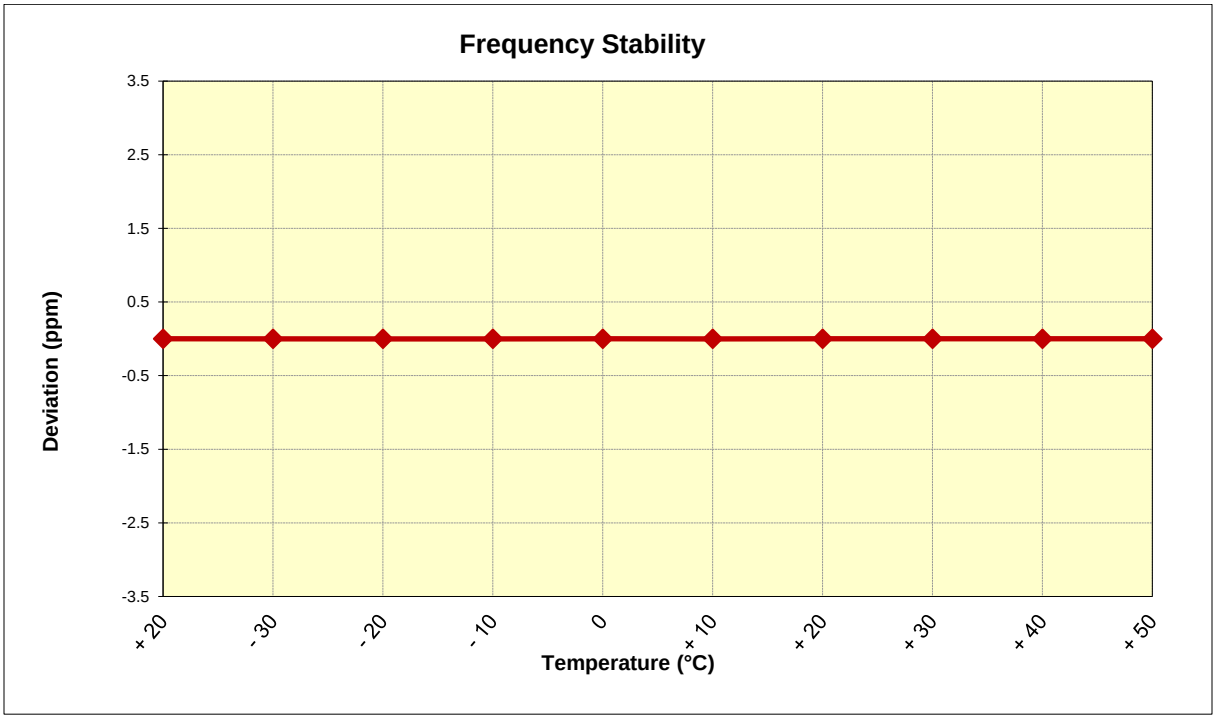


Figure 8-11. Frequency Stability Graph (LTE_B48_10M)

9.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the **EUCAST Co., Ltd. CBSD FCC ID: 2AXTR-EPL2248-1690** complies with all of the requirements of Part 96 of the FCC Rules.

10.0 APPENDIX. A

10.1 Conducted Average Output Power (EIRP)

Test Overview

A transmitter port of EUT is connected to the input of a signal analyzer. All measurements are performed as RMS average measurements while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies.

Test Description

KDB 971168 D01 v03r01 – Section 5.4
KDB 662911 D01 v02r01 – Section E)1) In-Band Power Measurements
ANSI C63.26-2015 – Section 5.2.4
ANSI C63.26 - Section 5.2.5

The measurement was made using a direct connection between the RF output of the EUT and the specturm analyzer. The specturm analyzer setting were as follows:

1. Conducted power measurements are performed using the signal analyzer's "channel power" measurement capability for signals with continuous operation.
2. RBW = 1 ~ 5% of the expected OBW
3. VBW ≥ 3 x RBW
4. Span = 2 ~ 3 x OBW
5. No. of sweep points ≥ 2 x span / RBW
6. Detector = RMS
7. Trigger Settings is set to "RF Power" for signals with non-continuous operation with the sweep times set to "auto". Refer test note 3 for details.
8. Trace mode = Trace-Averaging (RMS) set to average over 100 sweeps
9. The trace was allowed to stabilize

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

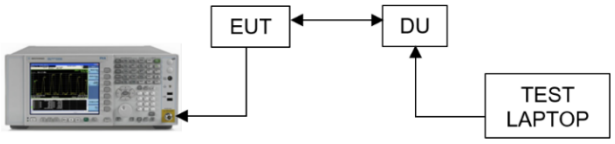


Figure 10-1. Test Instrument & Measurement Setup

Limit

N/A

Note

1. Conducted Average Output Power test result used to Grant of Authorization power and MPE.

2. Periodic trigger was used with gating ON. Gate sweeptime, Gate delay and gate length were set accordingly to capture ON time of the transmission.

3. MIMO Calculations are done considering output channel power for all ports and respective margins are calculated according to procedures in section 6.4 of ANSI C63.26 and section D of KDB 971168 D01 v03r01.

4. Consider the following factors for MIMO Power:
   g) Conducted power for each port is measured in dBm.
   h) Powers are summed up in linear using the measure-and-sum technique defined in KDB 971168 D01 v03r01-Section D.
   i) Conducted power per port (dBm) is converted to a linear value (mW). A summation of linear powers for all ports gives us the total MIMO conducted power in milliWatts (mW).

5. All transmit signals from different antennas are completely uncorrelated with eath other. So the the e.i.r.p. shall be calculated based on the aggregate power conducted across all antennas and maximum antenna gain G_{max}.

6. Sample Calculation:
   Let us assume the following numbers:
   e) Total MIMO Conducted Power as 1363.59 mW
   f) Antenna Gain = 6.0 dBi

Factors		Value	Unit
Summed MIMO Conducted Power (linear sum)		1363.59	mW
Summed MIMO Conducted Power (dBm)	= 10 * log (1363.59) =	31.35	dBm/10MHz
Antenna Gain		6.00	dBi
Total MIMO EIRP		37.35	dBm/10MHz

Channel	Port	QPSK	16QAM	64QAM
Low	0	28.45	28.43	28.53
	1	28.22	28.20	28.20
	Total Conducted Power (mW)	1363.59	1359.32	1375.55
	Total Conducted Power(dBm)	31.35	31.33	31.38
	Ant. Gain (dBi)	6.00	6.00	6.00
	e.i.r.p(dBm/MHz)	37.35	37.33	37.38
Mid	0	28.75	28.55	**28.77**
	1	28.10	27.99	**28.41**
	Total Conducted Power (mW)	1397.55	1347.65	**1448.78**
	Total Conducted Power(dBm)	31.45	31.30	**31.61**
	Ant. Gain (dBi)	6.00	6.00	**6.00**
	e.i.r.p(dBm/MHz)	37.45	37.30	**37.61**
High	0	**28.84**	28.69	28.90
	1	**28.29**	28.45	28.21
	Total Conducted Power (mW)	**1442.12**	1441.45	1440.46
	Total Conducted Power(dBm)	**31.59**	31.59	31.59
	Ant. Gain (dBi)	**6.00**	6.00	6.00
	e.i.r.p(dBm/MHz)	**37.59**	37.59	37.59

Table 10-1. Conducted Average Output Power Table (LTE_B48_10M)

Channel	Port	QPSK	16QAM	64QAM
Low	0	**31.55**	**31.94**	31.85
	1	**30.37**	**30.63**	30.37
	Total Conducted Power (mW)	**2517.82**	**2721.26**	2622.02
	Total Conducted Power(dBm)	**34.01**	**34.35**	34.19
	Ant. Gain (dBi)	**6.00**	**6.00**	6.00
	e.i.r.p(dBm/MHz)	**40.01**	**40.35**	40.19
Mid	0	30.93	31.25	31.18
	1	30.23	30.53	30.41
	Total Conducted Power (mW)	2295.18	2465.32	2413.21
	Total Conducted Power(dBm)	33.61	33.92	33.83
	Ant. Gain (dBi)	6.00	6.00	6.00
	e.i.r.p(dBm/MHz)	39.61	39.92	39.83
High	0	31.23	31.30	31.30
	1	30.39	30.82	30.84
	Total Conducted Power (mW)	2423.35	2558.78	2564.35
	Total Conducted Power(dBm)	33.84	34.08	34.09
	Ant. Gain (dBi)	6.00	6.00	6.00
	e.i.r.p(dBm/MHz)	39.84	40.08	40.09

Table 10-2. Conducted Average Output Power Table (LTE_B48_20M)